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NEW DIRECTIONS FOR GENERAL SCIENCE

A QUESTIONING OF CURRENT EMPHASES ON FOREIGN LANGUAGE

SYMPOSIUM THIS MONTH

FLEXIBLE SCHEDULING: AN APPROACH TO INDIVIDUALIZING INSTRUCTION IN SECONDARY SCHOOLS

— Theme for the Year —

INDIVIDUALIZING EDUCATION FOR ALL YOUTH

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# EDITORIAL

## THEME AND VARIATIONS FOR 1961-62

The *Journal* takes for its theme in 1961-62 INDIVIDUALIZING EDUCATION FOR ALL YOUTH. In building its composition for the year, the following monthly variations will be featured in the symposiums:

| | | |
|---|---|---|
| October | 1961 | Flexible Scheduling: An Approach to Individualizing Instruction in Secondary Schools |
| November | 1961 | Using Team Teaching to Individualize Instruction in Secondary Schools |
| December | 1961 | Impact of National Defense Education Act on Secondary Schools |
| January | 1962 | Freedom for Each Individual to Teach and to Learn: Critical Thinking and Commitment to American Ideals |
| February | 1962 | Using Teaching Machines to Promote Student Self-Instruction in Secondary Schools |
| March | 1962 | Each Pupil's International Responsibility: Implications for Secondary Schools |
| April | 1962 | Relating High Schools to Elementary Schools and Colleges |
| May | 1962 | Local Autonomy and the National Interest in Secondary Education |

This is the plan that will be carried out, assuming, of course, that civilization lasts for eight more months. With the world picture looming so menacingly, the nagging question often arises as to whether the less dramatic tending to one's own field of endeavor is the most significant action to be engaged in at the moment. We have concluded that the most important meaning to us of the critical world situation is to press forward with all possible dispatch to make the schools as good as we know how. No time must be lost. Never before has it been more evident that the relationships between peoples of the world must be based upon understanding, which is the product of effective education. We must act not only to make education more widely available to people everywhere in the world, especially to those who have been denied its benefits, but also we must ensure that greater emphasis be given to the quality and the appropriateness of the education for *each* individual. Hence the *Journal* theme this year is upon *individualizing* education. The greatest danger facing the world today, apart from a nuclear holocaust, is that the group,

the state, will overpower the individual, that the dignity and worth of each human person will be lost as a central value. As populations continue to grow explosively, as societies become more impersonal in their operations, a counteracting influence of personalizing all phases of life must be accentuated. One of the most important meanings for schools is for them to take a more flexible stance rather than a rigid, monolithic approach to the organization and operation of the educational program. Hopefully, this idea is permeating the thinking of educators and laymen alike, so that the main task ahead is to obtain the action necessary to achieve the results for which there is a growing agreement.

R. N. B.

## GOOD TEACHERS

A good teacher is usually considered the most important element in providing a sound education. But more than fifty years of serious research on teacher competence have failed to produce dependable knowledge about what this quality is and how it can be measured.

"Who's a Good Teacher?" is the question posed by a sixty-four-page booklet published by the American Association of School Administrators and the Department of Classroom Teachers, both departments of the National Education Association, and the National School Boards Association.

The study makes no attempt to give a conclusive answer. Rather, it is a summary and analysis of research findings designed to serve as a foundation for further study of an extremely elusive subject.

"What research says about teacher effectiveness is that it is not the clearly defined quality that many would have us believe," the report declares. "In fact, research indicates that teacher performance is one of the most complex human phenomena that we are privileged to study."

Although it is difficult to predict what qualities will make a teacher successful, the report says, "poor maintenance of discipline and lack of cooperation tend to be found as the chief causes of failure" in studies of unsuccessful teachers. "Health, educational background, preparation, age, and knowledge of subject matter, on the other hand, appear to be relatively unimportant factors in terms of teacher failure."

The study notes that there appears to be no such single person as the universally effective teacher. But it also warns that unless research on teacher effectiveness does not produce knowledge about teaching much faster and better than in the past, teachers are likely to be confronted by technical developments beyond their understanding and ability to handle.

—*New York Times*, September 10, 1961

# NEW DIRECTIONS FOR GENERAL SCIENCE

BY CHARLES H. HEIMLER*

The science consultant sat in the back of the classroom quietly observing the performance of the teacher. He had been directed to this class as an example of the superior job of general science teaching that was being carried on in this junior high school.

"And now," the teacher was saying, "this demonstration will prove that air has pressure." He proceeded to pour cold water over a large can that had been tightly sealed after a small amount of water had been previously added and heated until it changed to steam. Dramatically, as the cold water trickled down the side of the can, the walls of the container pulled in towards each other and the can slowly collapsed.

Later, while discussing the demonstration with a student outside in the hall after class the consultant was told, "Yes, that sure is a great experiment with the can. But this is the eighth time I've seen it done!"

Quite probably, if this class was typical of today's general science teaching, the collapsing of the can was only one among many activities that had been seen many times before.

This not uncommon repetition of demonstrations and exercises in general science has been brought about by two factors. One of these is the spiraling concept approach to science curriculum development. In the spiraling concept program the student repeats in each grade, in progressively deeper fashion, the study of natural phenomena. Although in theory this type of organization has considerable merit, in practice it often happens that the exact same demonstrations, exercises, and experiments are repeated in the same way from grade to grade without probing more deeply into the basic concepts and principles.

The second factor involved is the rapid and widespread increase in the teaching of science in the elementary school. During the last ten years considerable progress has been made in the teaching of science in

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grades one through six. However, much of the curriculum development in science education has consisted of taking material that has been traditionally taught in grades seven through eight and, with appropriate modification, introducing it in the primary grades. As a result, many of the exercises and illustrations now extensively employed in elementary school science are little different from those used in the upper grades.

Today's elementary school student in many school systems has opportunities to work with magnets, models of the solar system, simple chemicals, microscopes, microprojectors, and various other scientific devices. Moreover, where the spiraling concept approach to curriculum development is employed there may be a repetition of science experiences in the elementary grades as well as in the general science program.

The widespread increase in the teaching of science in the elementary grades has important implications for the general science curriculum. Further, changes that are now beginning to take place in the teaching of science in high school will also affect the content and design of courses in general science. New programs produced by the Physical Science Study group, those being worked out by the Chem-Ed Study group, the Chemical-Bond Approach committee, and the Biological Science Curriculum Study project hold forth the promise of radical changes in the teaching of physics, chemistry, and biology. In general, these programs tend to stress basic scientific concepts, the process of the scientific enterprise, and a reduction in the attention given to practical applications. If one of the purposes of general science is to prepare students for high school science, then these changes must be reckoned with.

Another related factor that has important implications for the general science program is the student's constant exposure to science in the popular means of communication—radio, television, newspapers, and magazines. It is most significant that today's students are coming to the study of general science with wider and deeper backgrounds, and with more mature interests than they were just a few years ago. This fact is well recognized by most teachers.

In view of the developments discussed here it appears that the teaching of general science should be headed in new directions—towards an upgrading of content, activities, and over-all organization.

Although it is not possible as yet to say with finality what changes should be made in general science the following list of recommendations is offered for consideration by those who are responsible for a program in seventh, eighth, or ninth grade general science.

1. The study of fewer topics in depth rather than the skimming over of many topics at each grade level. Some present general science programs cover as many as ten units in each semester.

2. The avoidance of the direct repetition of content and activities that are part of the elementary school science program.
3. The inclusion of material relating to the scientific process of investigation. This would involve the study of cases dealing with the work of noted science investigators, science projects, increased study of the history of science, and the use of open-ended science exercises and experiments.
4. The inclusion of descriptive material that is now taught in high school science but which is suitable, with appropriate modifications, for introduction into ninth grade general science.
5. The incorporation of junior high school mathematics into the general science course. Placing increased emphasis on quantitative as as well as qualitative observations and understandings.
6. The addition of material from the newer sub-sciences such as oceanography, and space science.

To summarize, although rapid strides have been made in introducing science into the elementary school curriculum and post-sputnik changes are beginning to take place in the high school, the content and organization of general science courses have remained fairly static. Yet, the implications are clear; general science may very well become the weakest link in the science education sequence. Pointedly, the time is ripe for new directions in general science.

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## ADVANCED PLACEMENT

More than 400 institutions of higher learning—over one-fourth of the nation's four-year colleges and universities—are offering talented students the opportunity to skip college work which they have already covered in high school. The program, known as "Advanced Placement," is now concluding its fifth year of operation by the College Entrance Examination Board.

When the board took over the program from a Ford Foundation-sponsored pilot project in 1956, 130 colleges were offering advanced placement. In that year, 1,200 students in 104 high schools took 2,200 Advanced Placement examinations administered by the Educational Testing Service. (Students may take these tests in more than one subject.) In 1960-61, the board estimates 13,000 students in 1,200 high schools took 17,500 examinations.

Students who apply for admission to college with advanced standing through participation in the Advanced Placement program have either taken college-level courses in their own high schools, have studied during the school year or in the summer at neighboring colleges, or have picked up sufficient knowledge of a subject on their own.

The amount of credit given an Advanced Placement student varies widely among institutions. According to a report made last week by the United States Office of Education, some universities have granted as much as a full year of credit toward a Bachelor's degree.

—*New York Times*, July 16, 1961

# SOME QUESTIONS CONCERNING CURRENT EMPHASIS ON TEACHING FOREIGN LANGUAGES

BY DENZIL E. WIDEL*

A new emphasis on the teaching of foreign language may be witnessed all the way from kindergarten to college. Large amounts of student time, teacher preparation time, and expensive equipment such as tape recorders, phonographs, and language laboratories are being consumed in language instruction. Some schools are patterning their facilities after such modern language laboratories as that of the Army at Monterey, California, or Georgetown University in Washington, D. C.

It appears as though the United States means to have their younger generation become a generation of linguists, or at least a generation that can order a dinner at their favorite foreign restaurant.

While schools are busy attempting to have students master or partially master a language other than English, it would seem to be worthwhile to ask some questions about the merits of taking a foreign language. Perhaps we are busily pursuing objectives that cannot be attained under present circumstances.

Some questions need answering:

1. Can we expect to have students speak a foreign language reasonably well after taking a language in grade school, high school, or college?
2. What is the forgetting rate of a foreign language once the language has been learned?
3. How does a person determine what language to take when the possibility of using that particular language is probably years in the future?

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4. Has research demonstrated whether professional people such as doctors, engineers, or chemists actually need or use any language other than English to carry out their work?

5. Does learning a foreign language help in understanding another culture better?

6. Does learning a foreign language assist international understanding?

7. Under present circumstances, where and when is the best place and time to begin the teaching of a foreign language?

This article will attempt not to answer these questions, but rather to analyze the reasoning used to support the taking of a foreign language. This may encourage research to determine the validity of this reasoning. The suspicion arises lest we may have accepted some of the objectives of our foreign language curriculum without very much serious thinking concerning the validity of the claimed objectives.

In considering the first question, "Can we expect to have a student speak a foreign language reasonably well after taking a language in grade school, high school, or college?", we might look first at what the Army Language School or the Foreign Services Institute of the State Department are doing, in order that graduates can get along in the foreign country of their expected assignment. These schools keep their students on a full-time basis for an intensive course ranging in time from six to nine months. For some of the more difficult languages, e.g., languages of the Near East, China, and Africa, it is now proposed that these schools will have courses ranging from 12 months to 24 months. To obtain results, these schools keep their students in class from four to six hours daily and in addition have assigned homework. The classes are generally no larger than six to eight students with some as low as three to four students per instructor. Teachers in these schools are usually native speakers. In addition, it should be remembered that the students are usually college graduates. These schools have the advantage that their students are anticipating an assignment to a foreign country where they will immediately use the language that they are learning. These schools also have the most up-to-date language teaching equipment available. If one of the objectives in public schools is to have students speak a foreign language reasonably well, after two or three years of the current type of teaching, we should take a closer look at the experiences of these professional schools. Some research studies of our current high school and college graduates to determine their fluency, might be fruitful. Enthusiastic supporters for teaching a foreign language to the majority of the school population, often indicate that many foreigners know several languages, and therefore, we should also. This should be looked at more realistically. It may be that foreigners who do know another language

have learned it because of economic necessity or because of the immediate proximity of the country of their second language, and therefore, have had the opportunity of practicing this language on a more or less continuous basis. Our students rarely have either of these two opportunities.

Consider the second question, "What is the forgetting rate of a foreign language once the language has been learned?" It assumes that the student has learned the language reasonably well but, like most American high school or college graduates, he will not have an immediate opportunity to be sent to a country where the language is spoken, and does not have the opportunity to put his second language to a useful purpose. How much of the language does the student forget after six months, one year, two years, or even five years of inactivity? It may be granted that most will remember how to say "yes," "no," "thank you," the numbers, and a few other words. If the rate of forgetting is great, perhaps we are not accomplishing the things that we think we are in the area of foreign language.

Next, the question arises, "How does a person determine what language to take when the possibility of using a particular language is probably years in the future?" How can the average student decide years in advance what language he will need in his work or in his travels. The number who leave school and go directly to a country of the language they have studied, is small. Even in traveling, if a student has learned German, Italian, or French, the chances are remote that he will spend more than a week or two in any particular country. Then too, in many of the touring spots, the nationals, because of economic necessity, have learned enough English to serve the tourists and many times prefer to use English. Certainly no one can deny that Americans are traveling more, both as tourists and businessmen in foreign countries. However, how can a student determine years in advance which language he should concentrate on in order that it will be useful to him at some future date.

For many years school counselors and others have advised that it is necessary for a student to know a foreign language in order to become a doctor, dentist, chemist, or other professional person. Is this statement valid? To obtain a Ph.D. a reading knowledge of several languages is required in order to do research. Is this really necessary today? It would be interesting to survey successful doctors, chemists, and even research scientists to determine the extent to which they use a foreign language as a tool in their profession. It may be that in view of saving time and ensuring accuracy, nearly everything of importance is translated into English, and is available in professional journals.

One of the classic reasons given for taking a foreign language has been, "That it helps to understand other cultures better and assists in

international understanding." Is this really so, or is it wishful thinking, with which we have been fooling ourselves? If it is the understanding of other cultures that we desire, perhaps a more direct study of a culture, rather than the learning of a language would produce greater understanding of the characteristics of other people. It might also be that we should state precisely what we mean by the understanding of a culture. This may be another point where some research could profitably be done.

In the area of international understanding, it is possible that we have overestimated the value of knowing a second language. There may be factors much more important than knowing the other fellow's language which would make for better international understanding. France, Germany, and some of the other European countries can be used as examples; their supposed understanding of each other's language has not promoted the cause of peace to any notable degree.

The last question, "Where and when is the best place and time to start the teaching of a foreign language?" The familiar saying, "the younger the child, the easier it is to learn a language," is seldom denied. However, unless a continuous follow-up program is systematically applied, how much of the language is the youngster going to retain? Many people know of cases where a youngster of four or five years of age returned to the United States after spending several years in a foreign country, and could, as the saying goes, speak like a native. Then after two or three years of disuse the child had almost totally forgotten the language.

The most effective placement for foreign language training, in order that a person can really use it, would seem to be just prior to a person's going to a foreign country where the language would be used. Most of the factors conducive to a good learning situation seem to be present with this placement, namely, the motivation and opportunity to put the language to use under realistic conditions. The effectiveness of this type of placement has been demonstrated by our Armed Forces, State Departments, private business, and by individuals who are preparing to go to a foreign country.

It is rather difficult to convince junior and senior high school youngsters that the learning of a foreign language now is going to be of much use to them in the remote future. They are usually more the realists than their elders in this case. The one conclusive argument which we have for the majority of junior high school, high school, and college students to take a foreign language, is that a language is a requirement of the university or college. Students knowing that there is little opportunity to question the authority of the university's requirements, proceed to invest classroom and home-study hours in something that may be of doubtful value. Research on some of the above-mentioned questions

might give us more confidence in our foreign language program, and certainly would be more convincing to our students.

After observing at first hand the usefulness of a second language while working in a foreign country, I would also suggest consideration of the following:

a. Offer an elective, exploratory course in foreign languages, open to all students in junior high school, high school, and college. The purpose of this course would be to expose students to a foreign language, and to give them an opportunity to determine if they have a particular ability for languages. This would assist the counselors and the students, when considering careers. It would also demonstrate to students that there are other ways of communicating and stating ideas, in addition to their own language.

b. The next step would be to counsel those students into foreign language courses who might actually be in need of a second language in their careers. Such students might be those who are going into foreign service, the military as a career, foreign business, or the teaching of foreign languages. This would be equivalent to the pattern of students who take as much mathematics and science as possible when they intend to enter engineering or science as a career. In other words, concentrate on foreign language when it seems that there will be a chance that the student will follow up the study of the foreign language in an actual work situation. This would avoid placing all college preparatory students and many others, in a foreign language class from two to three years, when at present the benefits from such exposure are mostly unknown. This would also give many students an opportunity to take courses from which they may use the information or skill learned.

c. The last suggestion offered is that if we are going to continue to offer foreign language instruction as at present, we ought to restate our objectives in realistic terms and in line with what research may now show is possible, and thus have goals that a student can expect to attain. Let us not attempt to fool the students and ourselves with unrealistic objectives.

# WHAT'S HAPPENING IN CALIFORNIA SECONDARY SCHOOLS

BY WILLIAM N. McGOWAN*

Late in the 1960-61 school year a tragic automobile accident in San Mateo County occurring during a lunch hour and involving high school students on a "joy-ride," focused attention of school people to problems revolving around maintaining an "open" or "closed" campus during the lunch hour. The State Department of Education conducted a survey on the subject, and a copy of the results of the survey, prepared by W. Earl Sams, Consultant in Secondary Education for the State Department of Education, is reported here.

REPORT ON SURVEY OF OPEN VERSUS CLOSED CAMPUS POLICIES OF CALIFORNIA JUNIOR, SENIOR, AND FOUR-YEAR HIGH SCHOOLS

May 26, 1961

Prepared by: W. Earl Sams, Consultant in Secondary Education

As of this date, 906 replies to the questionnaire on "Open Versus Closed Campus Policies" of California Junior, Senior, and Four-Year High Schools have been received and tabulated. These 567 senior and four-year high schools and 316 junior high schools reported the following facts:

TABLE I

Number and Per Cent of Student Population in the 906 Secondary Schools by Type of School and Open or Closed Campus Policy

| *Policy* | *Type of School* | *Student Population* | *%* |
|---|---|---|---|
| **Closed campus policy | Sr. and 4-yr. H.S. | 405,335 | 58.95 |
| Modified open campus | Sr. and 4-yr. H.S. | 150,937 | 21.96 |
| Open campus | Sr. and 4-yr. H.S. | 131,287 | 19.09 |
| Closed campus policy | Junior High Schools | 400,802 | 94.74 |
| Modified open campus | Junior High Schools | 11,587 | 2.74 |
| Open campus | Junior High Schools | 10,671 | 2.52 |

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** Closed Campus (All students except those specifically excused are required to remain on campus during the lunch hour). Modified Open Campus (Normally students are permitted to go off campus for lunch but are subject to certain limitations. Open Campus (Normally students are permitted to go off campus for lunch without limitations as to where they may go).

Senior and four-year high schools reported that 556,272 (80.91 per cent) of the total school population in these 567 secondary schools were operating a closed or modified open campus policy. Only 131,287 (19.09 per cent) were in schools having the open campus policy.

Junior high schools reported that 412,389 or 97.48 per cent of the student population in these 339 schools operated on a closed campus policy.

TABLE II

Number and Per Cent of Schools by Type of School Having Open or Closed Campus Policy

| *Policy* | *Type of School* | *No. of Schools* | *%* |
|---|---|---|---|
| Closed campus | Sr. and 4-yr. H.S. | 262 | 46.20 |
| Modified open campus | Sr. and 4-yr. H.S. | 164 | 28.93 |
| Open campus | Sr. and 4-yr. H.S. | 141 | 24.87 |
| Closed campus | Junior High Schools | 316 | 93.2 |
| Modified open campus | Junior High Schools | 11 | 3.3 |
| Open campus | Junior High Schools | 12 | 3.5 |

The number of individual schools reporting the three various types of lunch-time campus control policies presents a slightly different picture. The senior and four-year high schools reporting closed policy were 262 (46.20 per cent), the number reporting modified open was 164 (28.93 per cent), and the number reporting open campus policy was 141 (24.87 per cent).

The number of junior high schools reporting the closed campus policy was 316 (93.2 per cent), modified was reported by 11 (3.3 per cent), and open was reported by 12 (3.5 per cent).

TABLE III

Number and Per Cent of Senior and Four-Year High Schools by Size Having Closed, Modified or Open Campus Policy

| | | *Closed* | | *Modified* | | *Open* | |
|---|---|---|---|---|---|---|---|
| *School Size* | *No.* | *%* | *No.* | *%* | *No.* | *%* | *No.* | *%* |
| 1. 1-300 | 97 | 17.1 | 19 | 7.2 | 45 | 27.4 | 33 | 23.4 |
| 2. 301-500 | 55 | 9.7 | 13 | 5.0 | 18 | 11.0 | 24 | 17.0 |
| 3. 501-1000 | 98 | 17.3 | 35 | 13.4 | 36 | 22.0 | 27 | 19.1 |
| 4. 1001-1500 | 107 | 18.9 | 48 | 18.3 | 30 | 18.3 | 29 | 20.6 |
| 5. 1501-2000 | 105 | 18.5 | 68 | 25.9 | 21 | 12.8 | 16 | 11.4 |
| 6. 2001-2500 | 86 | 15.2 | 67 | 25.6 | 12 | 7.3 | 7 | 5.0 |
| 7. 2501- + | 19 | 3.3 | 12 | 4.6 | 2 | 1.2 | 5 | 3.5 |
| | 567 | | 262 | | 164 | | 141 | |

The policy by size according to enrollment in the senior and four-year high schools was reported as follows: The mode for the closed campuses was in the fifth size category, 1501-2000. The mode for the modified open campus was in the first size category, 1-300. The mode for the open campus was in the first size category, 1-300. Other comparisons are possible from the data presented in Table III. For example, the very small schools in the 1-300 size category reported a greater number of modified (27.4 per cent) and open (23.4 per cent) than closed campus operations (7.2 per cent), whereas the large-average or 1501-2000 schools reported more closed (25.9 per cent) than modified (12.8 per cent) and open (11.4 per cent).

Other comparisons of schools by enrollment categories are possible. The replies from all senior and four-year high schools reveal that about 27 per cent have an enrollment of only 500 or less, and 18.5 per cent have an enrollment of 2001 or more. The smaller schools (500 or less) reported 12.2 per cent closed, 38.4 per cent modified, and 40.4 per cent open, whereas the larger schools (2000 or more) reported 30.2 per cent closed, 8.5 per cent modified, and 8.5 per cent open.

The responses to the question, "Are the facilities for students *to purchase* and eat food on campus adequate?" were as follows: Those junior, senior and four-year high schools operating under a closed campus policy that answered "Yes" were 96.2 per cent; those operating under a modified open campus policy answering "Yes" were 70.9 per cent; and those operating under an open campus policy answering "Yes" were 74.5 per cent.

It is evident from the above that the adequacy of lunch facilities on the campus has either a marked effect on or is a direct result of the policy of the campus with regard to student control during the lunch hour.

All schools did not respond to the question, "Are you being *pressured to change* your current policy?" However, those junior, senior, and four-year high schools that did reply to this question revealed that: (1) 18, or 3.1 per cent, of the closed campuses have "some pressure from students to open them." (2) 44, or 25.1 per cent, of the modified campuses have pressure from the community to close campuses. (3) 37, or 24.2 per cent, of the open campuses have pressure from the community to close campuses.

Schools were asked to indicate the restrictions imposed if their boards granted blanket permission for all students to leave campus during the lunch hour. Those that were indicated most frequently are presented below in descending order:

1. Eating lunches on the property of neighboring residences.
2. Smoking in the neighborhood.
3. Sitting in their cars, etc., during the lunch hour.

4. Driving their cars, etc., during the lunch hour.
5. Going to their cars or other motor vehicles parked off campus during the lunch hour.
6. Being off campus without *special permit* issued to each student personally.

The supplementary letters have been ten to one in favor of the closed campus policy. The favorable comments have included:

1. We thought it was the law (Title V, section 63).
2. We wouldn't have it any other way.
3. Only way adequately to protect the interest, health, and safety of our students.
4. We were forced to it by the businessmen and neighbors in the community.
5. When our students surveyed the neighbors' attitude, we realized a closed campus was wise.
6. It's the district policy.
7. The school environment beats anything the neighborhood has to offer.

The remarks taken from the few supplementary letters supporting the contention that the open campus policy is superior could be summarized as follows:

1. A closed campus is like a prison.
2. Students should be permitted to make mistakes and correct them. "How else can they learn?"
3. Citizenship is learned by our students who get into conflict with our neighbors and then have to settle their differences.
4. Our student pride committee does a neighborhood clean-up campaign a couple of times a year.

The size of the campuses in acreage extended from approximately one acre accommodating 300 students to 120 acres accommodating 1350 students. Most of the San Francisco schools (many of which had only two acres) were on either a modified or closed campus basis.

A comparison was made between the various size categories according to acreage and campus control policies. It was discovered that there was no relationship between the acreage of the campus and the controlled campus policy. Approximately 30.2 per cent of the schools indicating a closed campus were in the smallest acreage size category, and approximately one-half of the schools in the largest size acreage category were operating on an open campus policy.

In answer to the question, "If you are operating on a closed campus policy, has the adoption of this policy on your campus created more prob-

lems than it has solved?", only 4.09 per cent said "Yes."

Many school administrators believe that the preponderance of pressure to change from open to the closed campus type of program may be directly related to the low level of public relations in some communities. Some who have remained in the same community for many decades indicate they have "witnessed parents who were once stalwart supporters of the school program gradually become embittered and extremely contemptuous of the school and its students." Many administrators believe these people go to the polls to register their vote and that perhaps it would be wise for all schools operating unlimited open campus policies to re-evaluate their effectiveness first by sampling the attitude of the community.

W. Bruce Kirkpatrick, former President of California Association of Secondary School Administrators who is Principal of John Marshall High School in Los Angeles, summarized the opinions of California high schools enrolling 58.95 per cent of the senior and four-year high school student population:

> "I am heartily in favor of the closed campus policy during the school day including the lunch period. Although it does involve some difficulties concerning control and supervision, I believe it essential to maintain a closed campus if we are to exercise the supervision of pupils with which we are charged and if we are to avoid severe criticism on the part of neighbors and local businessmen in the community."

Another high school Principal, John C. Holt of Los Angeles High School, states in part:

> "We feel that such a program (closed campus) is an absolute necessity both for the protection of individual students and for the welfare of the school. As to 'policing the situation,' we do not believe in it as such. We depend on a cooperative student body that has been informed concerning our policy. Except for a few, the students understand that a closed campus is a protection for them."

The tragedy of Thursday, May 25, 1961, in Redwood City, highlights the problem. The death of one freshman and mutilation of other occupants of the car being used for a noon-hour open campus "joyride" is a sad reminder that the Title V, section 63, was designed to help protect our youth.

# SYMPOSIUM

## *Flexible Scheduling: An Approach to Individualizing Instruction in Secondary Schools*

### Introduction

Each summer now for almost a decade the California Association of Secondary School Administrators has sponsored work conferences on topics of current importance in the developing program of secondary education. The substance of these conferences has been reported in one of the fall issues of the *Journal*. In cooperation with Stanford University, a one-week conference on Flexible Scheduling was held July 17-21, 1961 on the Stanford campus. Originally planned for approximately 75 California high school administrators, the demand not only from California but from across the nation was such that plans were recast to accommodate a conference of over 200. Representatives from the east, the south, the middlewest, all parts of the west, and Hawaii participated. This interest reflects the growing national leadership being exercised by the California Association of Secondary School Administrators and underlines the soundness of the decision last year to change the name of its official publication from *California Journal of Secondary Education* to the shorter and more appropriate title *Journal of Secondary Education*. The symposium this month is based upon a selection of materials that were presented to the July conference.

Many promising developments for improving high schools are running into the thorny problem of how they can be scheduled. How can more flexible schedules be constructed that will permit students to study a wider variety of courses under circumstances that permit considerable individual responsibility? How accommodate in the schedule the appropriate variety of course structures to fit the nature

of the different subject-matter fields, the varied abilities of students, and the kinds of instruction appropriate thereto? The conference was directed to the answering of such questions. The reports in the symposium this month attend not only to the practical first steps and ways specific schools have approached the problem, but also to the larger issues of the kind of secondary education needed in today's world that flexibility of scheduling may help to achieve.

The 1961 summer conference on Flexible Scheduling was developed by a planning committee consisting of CASSA staff and members William N. McGowan, Leland Russell, Joseph Hill, and Vincent Claypool. The directors of the conference were J. Lloyd Trump of Washington, D. C., and Dwight W. Allen and Robert N. Bush of Stanford University. The executive secretary of the conference was Scott Thomson of Stanford. The *Journal* is indebted to them and to all who made presentations to the conference for the material that they have made available for this symposium. Space prohibits a complete report of the conference deliberations. Those interested in the problem can obtain a solid introduction from three documents: (1) the symposium presented here this month; (2) a publication entitled A NEW DESIGN FOR SECONDARY EDUCATION: ASSUMING A FLEXIBLE SCHEDULE which was distributed to the conference, and which will be re-issued later in the year for wider distribution; and (3) the recent final report of the National Association of Secondary School Principals' Commission on Staff Utilization entitled FOCUS ON CHANGE.

Since there is such widespread interest in the problem of flexible scheduling, the *Journal* urges those who are experimenting with variations of the conventional schedule to report them to the *Journal* so that these experiences may be more widely shared this year.

# DEVELOPING AND EVALUATING A CLASS SCHEDULE TO HELP EACH PUPIL LEARN BETTER

BY J. LLOYD TRUMP*

Modern electronic data processing equipment can be a boon to the further development of quality in education. But it can also be used simply to do faster what should not be done anyway and thus delay or forestall changes that could improve dramatically the services of schools to individual students.

The key to higher quality in education in the future—and to the more effective use of the technological marvels of this age—lies in the development of a different conceptual basis for the schedule of classes. The purpose of the schedule is to help each individual student to learn better. This goal seeks for each student the development of his mind and body to make maximum use of his talents, to increase personal responsibility for his own learning, to develop his creativity and inquiry, and to improve his effectiveness in thinking critically in solving problems, and in working with other people also trying to develop their talents.

## Three T's That Limit Today's Schools

Three T's characterize today's schools and stand in the way of the optimum achievement of the goals emphasized in the preceding paragraph. These T's are *togetherness, terminableness,* and *tightness.*

Today's concept of education calls for much group activity in schools —much *togetherness.* Students too seldom are permitted the experience of planned independent study in places designed for that purpose. The setting for instruction is the self-contained classroom. And the classrooms

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of the secondary school are even more self-contained than those of the elementary school. The self-contained classroom concept says in effect that almost all the learning experiences of individuals must be in groups of 25-35 within a given room for 45-55 minutes per day, the same time of day, five days a week for a semester or two, with one teacher in charge. That one teacher is responsible for directing all phases of learning for that group of students.

The educational opportunities for students in the self-contained classrooms of secondary schools are limited by the talents of the particular teacher which the schedule of classes gives them. Individual differences in talent exist among teachers as they do among students. Opportunities are also limited because it is usually not financially feasible to provide in each schoolroom all the material aids to instruction that modern technology provides. Overhead projectors, sound film projectors, video and audio tape recorders, television receivers, and other instructional aids can not reasonably be furnished in every classroom. And there are scheduling problems and other difficulties which prevent maximum use of these aids when they are placed in special audio-visual rooms and students are expected to go there as groups from their self-contained classrooms.

The educational setting fosters mass instruction—even though the *mass* may be 25-35 students at a time. The creation of sub-groups in the classroom also represents students working together. Students are herded together in even larger masses in study halls. Assignments, reports, and evaluations are made largely on a mass basis. The schedule of classes in today's school portrays learning as something that happens when students work with a large degree of togetherness.

*Terminableness* also characterizes today's schools. Students "take" a course during a specified year, pass the examinations, and then in effect are permitted to forget it. The school requires one year, or two, of science and none in other years. The student accumulates a specified number of credits, or reaches a specified age, and his formal education is terminated. In spite of teacher protestations to the contrary, the organization of the curriculum sponsors a terminal point of view on the part of students—and this terminableness is not based on individual differences among students but rather on such mass arrangements as "16 units of credit" or "attainment of age 16" or whatever the local regulations specify.

The *tightness* of the school day also limits the school's attention to individual differences among students and teachers. School bells in the secondary school punctuate the school day into look-alike periods and keep individual students from caring very deeply about anything. So does the notion that a student must sit in a class 50 minutes a day, five days a week, for a semester or a year in order to "take" a given subject. Uniformity characterizes administrative arrangements for both students

and teachers. Variations are difficult to make because of the tightness in the schedule, in the spaces where learning can take place, and the rules and regulations adopted to insure a "smooth running school."

The schedule for recognizing individual needs of students must attack basically these three T's if the school of the future is to be substantially better than that of today. The analysis first needed concerns the individual student.

## The Individual Student

Motivation is a key element in the school's program for treating students as individuals. The individual student works more nearly to his capacity when he is placed in contact with teaching that stimulates him to his best efforts. No one teacher typically can do this most effectively all the time for a given group of students; few teachers have talents that diverse. Several teachers carefully selected can provide better motivation if each does what he is most interested in and most able to do in a given subject area, or with a certain group of students at a particular time. Thus a given individual student has a better chance to "catch fire" from contact with an exciting teacher who is both competent in the phase of subject he is teaching and in his knowledge about the students he faces.

Motivation also comes to students who can work on projects that seem important to them personally. Students need to work for extended periods of time in well equipped workrooms, in or outside the school, on individual study projects. The school of the future will have workrooms or laboratories in all subject areas equipped with the "tools of the trade" in that subject. For example, a social science workroom will have calculating machines for tabulating research data, typewriters, equipment for making maps and charts, programmed learning books and machines, listening, viewing and recording devices, books, and other materials that social scientists use. Individual work spaces with storage facilities will be available for use by individual students.

The schedule needs to provide time so that students can work as many hours per week in the workrooms as professional counselors and teachers may decide. Since the workrooms will be open after conventional school hours and on Saturdays and during the summer, a given student may work as many as 20-30 hours per week in these workrooms. Some of the facilities will be found in local industries, offices, and libraries. Students may be frustrated in a self-contained classroom with one teacher and limited facilities; they will be motivated more by the flexibility of the workroom arrangements made for them.

Motivation of individuals is further stimulated by discussions among students of like interests and talents. Such groups should number no more than 15 if all members are to participate in a reasonable manner

and not feel isolated and insulated from the group. Provisions for small group discussions of this type are needed in the schedule of classes.

Yet another motivational factor is reinforcement of learning, the more immediate the better. Programmed instruction devices can provide some of this motivation by permitting each student to learn at his own pace, by letting him know immediately whether or not he has learned, and by giving him instructions for his next steps without marking time while the teacher gets around to him or while the slower students finally catch up or are removed to a remedial group. Instructional assistants can evaluate some phases of student productivity and thus give the results to students more quickly than in the conventional school where teachers are overburdened, and sometimes bored, with correcting routine student work.

So the school that wants to schedule students better for individual learning recognizes individual motivation as a basic feature of its program. This goal requires scheduling students with the most exciting and able teaching either by a physically-present teacher, carefully selected from among the staff in the school, or from some person in the community for that particular subject, or by bringing in some other outside teacher by means of television, video or sound recording, or on a film or slides. The school assembles large groups of students for this purpose to save the time and energy of these teachers and to make broad contacts with these teachers logistically feasible. The school also schedules individual students in appropriate places and for appropriate lengths of time for independent study. And the school also schedules small discussion groups limited in size to 15 or fewer students for motivational discussions.

Scheduling for individual differences requires other arrangements as well. Progress through school is an individual matter. Today's school operates on an annual basis. Subjects are organized on that basis and the school tries to fit individual students into that pattern. The curriculum of the school of the future will be organized into steps or phases rather than annual segments. Students will progress through these steps in the elementary and secondary schools at their own pace as determined by professional decisions based on personal achievement and individual growth and development. Thus a talented and relatively mature student may be admitted to school at age four or so and be ready for college at 15 or 16 while another is admitted at age 5 or 6 and is ready for college at 17 or 18. Another student is admitted at 5 or 6 and by age 15 is in school part time and working part time.

Professional decisions also determine the nature of the individual student's program in school. The future school will determine for each student how much time and in what areas of knowledge (above the basic education required of all) he spends in large-group instruction, small-group discussion, and independent study.

Individual programming thus becomes an essential feature of the school. Such statements as "each student is expected to do two hours of homework daily" will be passé. Independent study will replace the concept of homework which today is so largely an assigned matter. Independent study places emphasis on trying to discover new truths, new interpretations, better systems of classification, new models, and other unique uses of the knowledge and skills developed in the large groups, the discussion sessions, and through the use of programmed learning devices. This kind of independent study requires not only a different approach to the curriculum and teaching methods, but also a schedule for each student that will enable him to work on matters that are good and interesting for him to explore.

The schedule will cause each student to learn to his capacity the basic understandings needed by good citizens in all areas of human knowledge and achievement. So long as a student is in school that knowledge will be kept up to date and reinforced. Thus the school fosters the notion that a subject is constantly studied and inquired about so long as life lasts. The schedule will, however, also provide the individual student with the time to study in depth those areas of knowledge that are especially interesting for him and in which he is most competent. The proportionate amount of time for depth of study will increase with the maturity of the student, each at his own pace. Professional decisions based on careful individual evaluation will determine the relative emphasis.

## Evaluating Individual Achievement

The concept of helping each individual pupil learn requires changes in appraising and reporting pupil progress. Evaluation in today's school is so nebulous that parents, colleges, employers, and pupils themselves often are quite uncertain about just where an individual stands. This uncertainty is a key factor in the great increase in nationwide testing today. Evaluation should report to each of the listed persons these three aspects of development for each student: (1) what he *knows* and can *do;* (2) appraisal of several selected aspects of his growth and behavior; and (3) his projects completed during independent study.

Present nebulous grading schemes such as A, B, C, D, and F, with their accompanying definitions of excellent, very good, average, fair, and failing, give inadequate and inaccurate appraisals of achievement and often bring to school teachers and administrators criticism from all sides. For example, today's school may report that a girl has had two years of typing with grades of B which by definition means to a prospective employer that "she can type in a *very good* manner." Actually the school should report that after completing all the typing courses offered by the

school this girl can type on an average 53 words per minute, and that when she does so, she will average 4 mistakes. Also, out of a typical list of 100 words used by adults she will misspell 6, and so on. The school should report in every subject area honestly and accurately, based on standardized and teacher made tests, precisely what each student knows and can do. These data should not be clouded by whether the student bathes regularly, smiles appropriately, is punctual, and does a number of other things that a given teacher likes or dislikes. Nor should the data be clouded by grading the student on the basis of other students in his particular class in the *local* school.

Secondly, those in the school should select in each subject area the most significant aspects of student behavior that can reasonably be evaluated by the teacher who knows best the work of the student. Ordinarily, that is the teacher who works with the student in small-group discussion and independent study. Such aspects of behavior as the following can be selected for appraisal: ability to think critically; development of appreciation for the opinions of others; application of basic principles in new situations; understanding of the techniques of moderation in social action; punctuality in meeting obligations; and many others. The professional judgment of the teacher will then rate a given individual on a Likert-like scale, ranging from the very poorest to the very best among all of the students that he has ever known.

The third aspect of evaluation concerns the quality of independent study. A record should be kept, by the teacher who knows the student best, of the nature of the projects completed plus an appraisal of the quality of the undertaking. These subjective judgments should be made as objective as possible through the development of criteria and the applications of scales.

Incidentally, school officials and teachers in attempting to judge the excellence of the total school program for individual differences should analyze carefully all three of the foregoing types of evaluation and make comparisons with previous groups of students in this school or comparable groups of students in other schools.

## The Role of the Schedule Maker

The schedule maker, and this term here symbolizes the principal of the school, the administrative-supervisory hierarchy, and others of the total staff, has three responsibilities: (1) to conceptualize a schedule that will serve individuals better; (2) to develop a public relations program based on experimental approaches to the solution of educational problems; and (3) to produce a schedule that will actually reflect the concepts and the public relations.

The primary investigation of the schedule maker should *not* be to discover what data processing equipment is available to help make the schedule. Unfortunately that is the kind of approach that is too often taken. The result is that school buildings are planned mainly by architects (the most able of whom complain that they can not obtain imaginative educational specifications from the school people themselves) and the curriculum is developed by textbook writers and manufacturers of transparencies for overhead projectors (who also have difficulty in obtaining specifications from teachers and principals).

The basic issue in education today is "who will call the shots?" School people sometimes complain about the influence upon schools by business, government, the foundations, and the like. The trouble is that local control is being lost by lack of study and experimentation with resultant specifications.

Inconsistent or inadequate concepts of education can plague schools and cause inefficient and ineffective instruction. Language laboratories are installed in some schools largely because government funds are available and other schools are doing it—and the rooms are only partly or uncertainly used. Some schools engage in team teaching because this is a prestigeous thing to do, and so they engage only in large-group instruction, or fail to give teachers common time together to plan and evaluate, and do all sorts of things that show inadequate or incomplete understanding of the purposes of team teaching. So it can be with providing better education for individual differences. Some speakers and some publications about individual differences reveal quite inadequate understanding of meeting the needs of individual students as attempts are made to rationalize existing school arrangements such as self-contained classrooms, rigid schedules, uniform policies for all teachers and students, and so on.

What do you believe? Do you see the various aspects of the educational program in your school in relation to a clear concept of educational provisions for individual students? Do you have a carefully planned program of action that includes plans over several years? Are your educational specifications sharply drawn? Do you have the courage to experiment? What kinds of help do you need, and from whom?

The second major consideration is with public relations. Schools with long histories of quality in education are schools that have constantly sought better ways of doing things through experimentation. Other schools can take a cue from their experiences. The school can show the public the reasons for an experimental program, the procedures that will be followed, and how the results will be evaluated. Systematic and readable reports can be furnished regularly through the imaginative use of the various media of communication. If the results are satisfactory, the public

can be told how the program can be expanded to other parts of the school and what it will cost to do so.

Experimentation will succeed better when it is carefully planned, the design is such that the results can be evaluated accurately, and when external factors are arranged so that a reasonable test of the new procedures is possible. Teachers need leadership and support to conduct effective experiments and demonstrations. The schedule maker must spearhead and encourage new ideas and tell the public about them.

The public will respect effective leadership that is seeking better ways of doing things. They expect leadership from industry and from other professions. They also expect leadership from the profession of education. They can not respect persons who merely want the lay public to tell them how to run schools when that public is quite uninformed about better ways to schedule individual students for better learning.

The third task of the schedule maker is to do something. Some very imaginative approaches to scheduling for individual differences are being reported at this conference. Others have been reported elsewhere. Some of these approaches were made in connection with studies sponsored by the National Association of Secondary School Principals during its staff utilization studies.

The most imaginative of these schedule modifications have been made by old-fashioned hand procedures. This statement does not advocate hand procedures in scheduling. Obviously, computers and data processing equipment can save time and hold in memory data that the hand techniques can not do. But these people who wanted change first came to the concept of change and then did something about it even if they did not have available the benefits of modern technology. That is what is meant by *doing something.*

No one knows exactly what the school of the future will be like. Some ideas are described in a recent book, *Focus on Change—Guide to Better Schools.*[1] A *Study Guide,* designed to accompany that book is available from the author without charge for single copies. The suggestions for study and the annotated bibliography can help you and others in your school plan how you will change the schedule of your school to serve individuals better. You have the green light. Are you prepared to start?

[1] J. Lloyd Trump and Dorsey Baynham. *Focus on Change—Guide to Better Schools.* Chicago 80, Illinois: Rand McNally Company, 1961. 147 pp.

# FLEXIBLE SCHEDULING FOR WHAT?

BY ROBERT N. BUSH* and DWIGHT W. ALLEN†

A major groundswell of interest in breaking the lockstep of the conventional high school schedule is a prominent feature of the American educational landscape today. From whence did it spring? Will this effort to find a more pliable means of organizing and conducting high school education persist? Or will it turn into another short-lived fad? Part of the answer will lie in the extent to which the educational values to be achieved are carefully delineated and the extent to which experimentation is undertaken in a serious manner with long-range educational values clearly in mind. It is important in this connection to trace the roots of this movement and to note the educational framework within which it has developed.

The idea of secondary education that developed in the United States has been one of this country's boldest thrusts on the frontier of human affairs. During the 18th and 19th centuries America forged a new concept that secondary schools should be freely available to all youth who wished to attend. During the first half of the 20th century the United States took another bold step in making education compulsory, not just through the elementary school but also through the secondary school years. This revolutionary goal of a high school education for all has almost been achieved. Until recently no other country ever envisioned, much less attempted, to realize such a goal. But events race onward as ideas flow quickly and forcefully around the modern world. Following World War I, countries in many parts of the world observed the unprecedented level of material well-being that the United States had achieved. Surmising that this was not unrelated to the extensive provision for schools in the United States, they have been adopting for themselves this same goal and have been rapidly expanding and democratizing their schools.

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A further unique feature of secondary education in the United States, in addition to its universal character, has been the *comprehensive* high school, which has meant a single institution in each community which everyone attends irrespective of his status or aim in life. Here have mingled the children of the rich and poor, the bright and dull, the devout and heathen; no different tracks and separate schools as in Europe where students were placed in different schools—a system which reinforced established, rigid class lines.

Even though some recent criticisms have suggested that secondary schools in the United States should revert to the European pattern, it now appears, after thoughtful examination, that this alternative is not acceptable, and that the basic idea of a comprehensive secondary school remains sound for this country. In fact, there is evidence of considerable movement in this direction in other parts of the world. But the extensive critical public discussion of the American high school has led to the conclusion that even though it was a pace-setter in the last century, and has been a vital factor in helping to achieve a high standard of living, this is no time for complacency. Quite the opposite. It is now time to move on to new frontiers and again to conceive a new American dream and a new standard for ourselves and the world.

The *new* goal, which is now beginning to emerge, refers not to amount and numbers (everyone in school for a given number of years), a quantitative standard of the past, but rather to a quality of excellence to be achieved in the education provided for each and everyone in high school. While the debate as to what shall constitute an education of the highest quality for each pupil has not been concluded, there is more than a suggestion that the new aim may be even more lofty in its conception than its predecessor. The new goal emerging from public discussion of secondary education is this: all youth shall by the end of compulsory schooling be so launched in a broad, liberal education—with no significant gaps—that they will continue it as a lifelong pursuit; further, each person's education will have been so planned that he will have opportunity and be encouraged to develop, as early as his unfolding talents are discovered, one or more lines of specialization which will represent the flowering of his own unique interests and abilities. In the past, the plan has been to have a liberal education for those going to the university and the professions and a specialized vocational training for those going immediately to work. In Europe those two streams have been diverted to separate schools. In the United States they are both in one school. But the new concept is one that holds that the level of education needed in the next half century—adequate to meet the needs of the commonwealth as well as of the individual—requires that for everyone both a liberal and a spe-

cialized education shall have been well begun by the end of compulsory schooling.

Already overcrowded with pupils, with more to come, and confronted with the necessity for reaching higher levels of excellence than ever before regardless of severe shortages of teachers and finances, the American high school is faced with the necessity to break through to new, more efficient and effective ways lest it fail in its historic mission. Despite such formidable obstacles, there is reason to be optimistic. For already signs may be seen in secondary schools throughout the land that teachers and administrators are working to turn this crisis into new opportunity.

National commissions of scholars, teachers, and educationists are at work revising the high school curriculum in the different subject-matter fields. Experimentation with television, tape recorders, teaching machines, and with other fruits of modern technology is opening new vistas for enhancing learning. While each of these many avenues appears promising, they cannot all be fitted into the high school as it is now organized. Those concerned with each of the subject-matter fields are convinced that they could do much better if they had more and better prepared teachers with lighter loads, if they could have more of the pupils for longer periods of time, and if they had greatly expanded and improved facilities! Obviously, all that each group wants cannot be granted, for time, money, staff, and space are not unlimited. Some accommodation has to be made.

In an understandable concern with trying to organize secondary schools for everyone, the present high school developed a standard system of units and credits, with all subjects meeting for the same number of minutes per period, periods per week, for pupils of all levels of ability. Everyone, the present regulations state, shall between grades 7 and 12 take five years of English before graduating, which means five 55-minute periods per week for the 36 weeks of the two semesters of each year. One chief shortcoming of such standardization has been that with physical education required each year, English for five of the six years, and social sciences for four years, pupils are shortchanged in their education in science, mathematics, foreign languages, and the arts—each of profound and growing importance in these times. With mounting knowledge and increased sophistication about children, their educational needs and how they learn, it becomes difficult to ignore the fact that all children do not need the same amount of time to learn specific things. Nor do they come to school with equal backgrounds and talents. Some pupils entering high school are more advanced in a subject than others will be upon graduation. Some will be able to communicate in a second language in two or three years' study, others will take five or six years. Some pupils with excellent achievement and background in one subject would be better off if they were to spend their time in studying another subject, rather

than time-serving to meet a requirement. The present lockstep of six years to graduate and a rigid set of course requirements does not make sense. Hard and fast rules that will fit all pupils are difficult to find. While the curriculum as a whole must be designed, that portion of it which each individual is scheduled to enroll in should result from a sensitive, objective, and highly personalized diagnosis of his needs. Pertinent questions emerge: Could not requirements be arrived at and stated more flexibly, so that these important differences in pupils be taken into account? Would not some kinds of subjects be better taught in large blocks of time and others with shorter and more frequent opportunities for practice? The answers are obviously yes, but as practical school administrators and teachers ask–how can programs of such flexibility be scheduled?

The promising results of many experiments now in progress will depend for their wide application, upon the ability to arrange the schedule of the high school so that these different courses and curriculums can be accommodated. To make possible the fitting together of the separate facets of the problem, a new design for high school education needs to be formulated. It should strike a balance between curricular requirements and electives. It should guarantee no significant gaps in the education of any pupil but also take adequate account of his individuality. This new design should also provide flexible arrangements for the conduct of classes, so as to consider not only the pupils' differences, but also those of the subjects, and the talents and training of teachers.

The questions that need to be asked of teachers in each of the subject-matter fields are these: "If you could have all pupils study continuously throughout high school in your subject, how would you arrange it?" "What would be your aims?" "What different groups of pupils would you provide for?" "Would each group take the same curriculum, but only at a slower or faster pace? Or would you have different aims and different materials and different amounts of time for the best teaching of pupils of different abilities and interests?" "What size classes and what kinds of staff would be most desirable?" "What content would be most useful?" "How would you evaluate the results?"

The possibility of developing a flexible high school schedule to serve rather than stifle the educational needs of pupils comes closer to reality with the advent of electronic data processing procedures and giant, high-speed computers. These machines have been used in a variety of complex industrial, governmental, and military applications. As Professor Oakford from industrial engineering indicates in his article in the symposium which is based on the truly pioneering work he is directing, the application of these modern procedures to high school scheduling appears most promising.

The foregoing analysis of the educational values to be achieved through a more flexible approach to scheduling may be summarized by presenting seven assumptions on which it has been based.

Assumption 1. *High School is the period of schooling typically included in grades 7-12.*

In the 19th century and during the early years of the 20 century, the American high school was considered to be a four-year institution consisting of grades 9, 10, 11, and 12. It rested on an eight-year elementary school. The break between elementary and secondary education occurred between grades 8 and 9, at the age of approximately 13 to 14 years. Beginning in the second decade of the present century, the educational structure has been in process of reorganization. The break between elementary and secondary education was moved back two years so that it now occurs for a majority of pupils after grade 6 or at the age of 11 to 12 years. In this particular, American education is coming more into line with education elsewhere in the world. Even though the idea has not become universal policy, the trend runs strongly in this direction. Consequently, in this discussion, secondary education is used to refer to that period typically included in grades seven through twelve, the age span being roughly from eleven plus to seventeen or eighteen. The beginning of secondary education occurs at about the onset of puberty. At this time schooling begins to be characterized by teachers who are specialized in the different subjects, with pupils separating out into special classes for each subject. High school is viewed as a continuous six-year program.

Assumption 2. *All students should have continuous, rigorous study in breadth and depth in all basic subject-matter fields throughout the six secondary school grades.*

This second assumption is the most far-reaching and represents a major departure from present practice. All students should have continuous and rigorous study in breadth and depth in the enumerated six basic subject-matter fields and be provided with individual and group guidance throughout the full six years of secondary schooling. These fields are:

a. *Arts* (Visual, Performing, Practical)
b. *Languages* (English and Foreign)
c. *Mathematics*
d. *Natural Sciences*
e. *Physical Education and Health*
f. *Social Sciences*
g. *Guidance*

The arts, visual, performing, as well as the practical have been combined.* English and foreign languages have been considered jointly. If foreign language is taught with the expectation that students will gain basic masterey then the further consideration of literature and other aspects of the cultural appreciation of language will result in more commonality. Mathematics, the natural sciences, the social sciences, physical education and health complete the suggested areas of curricular emphasis. At present physical education is the only subject in which the principle of continuous study prevails in the secondary schools. No objection is made to the fact that physical education is required for study during all six years, but rather to the fact that it is the only subject considered to be worthy of such continuous study. These other five areas, it is here assumed, are also sufficiently valuable to merit continuous study in depth and breadth.

Assumption 3. *In each subject area several groups of students can be identified whose needs are sufficiently distinct to require a discrete program of studies.*

It must be quickly asserted, following Assumption 2 above, however, that while all pupils should study continuously in all of the above subjects, the proportion of time devoted to a particular field, the distribution of that time, and the nature of the content selected from that field, ought to vary according to the needs of each individual and the social demands that his goals, aspirations, abilities, and circumstances require. Thus while there should be a set of common requirements, each pupil's program would be planned for him and be different from that of every other pupil. Each subject-matter field will provide for several different groups of pupils. A student may be in different groups for different subjects. Furthermore, additional allowance for meeting individual needs is provided within each group. The proportion of students in each group will vary from school to school. In a particular subject, provision ought to be made for those with high, moderate, and limited ability as well as for those with high and limited interest. In some subjects remedial sections will be needed. Special provision ought to be liberally made for those pupils who are gifted in a subject.

Assumption 4. *Each subject when properly taught will include four basic types of instruction.*

Any subject, properly conceived and properly taught, is likely to include four kinds of instruction. Some kinds of instruction can be carried on more effectively in *large groups;* other subjects require *small-group*

* The arts, here considered as general education, would be part of the educational program each year for all students. For some students this area would provide vocational subjects as well. Included in this category are industrial arts, homemaking, agriculture and business, as well as music, painting, crafts, sculpture, and dramatics.

instruction; some topics and pupils will probably require a considerable amount of *independent and individual instruction;* most subjects will require special *laboratory* facilities.

Assumption 5. *Adequate instruction in each subject-matter field requires senior teachers who are both well trained in their subject-matter fields and highly skilled in teaching, who are assisted by less highly trained members of the instructional and supporting staff.*

It is assumed that in the interest of effective education teachers should be assigned and used in the fields where they are well prepared. This contrasts with the too frequent current practice which spreads teachers over several fields and attempts to have them perform in fields where they are not fully competent. Each highly trained teacher ought to be assisted by others who may be less highly trained. The senior, responsible, mature, professional, career teacher may appropriately be responsible for any one of the major types of instruction suggested.

Assumption 6. *Class size, length of class meeting, number and spacing of classes ought to vary according to the nature of the subject, the type of instruction, and the level of ability and interest of the pupils.*

It is logical that class size, length, number and spacing of class meetings ought to vary according to the nature of the subject, the type of instruction, and the level of interest and ability of the students. Nonetheless as high schools are now organized, these conditions do not prevail. A youngster is required to take mathematics before he graduates, whether he is remedial or gifted, for fifty-five minutes daily in a class of thirty with a teacher, for two full years. A similar requirement, varying in the number of years, is true in music, in science, in foreign language, and in other subjects of the curriculum. While convenient administratively, this is not sensible educationally.

In scheduling classes, the nature of the subject ought to be considered: whether primary emphasis is upon skill or concept development; whether emphasis should be placed on short-spaced periods of practice or longer concentrated periods of study; whether or not, as in science, the need is for longer periods of time for laboratory, as contrasted with vocal music training where there is no preparation period and the maximum benefit for one session may be obtained in a half hour or less; whether or not the total time required to accomplish the purposes of the course should be 90 minutes or 300 minutes per week.

Furthermore, some phases of instruction—the making of assignments, the administration of tests, the presentation of information—can be much more economically accomplished in larger groups. Other kinds of activ-

ities, where genuine group interaction is necessary, where testing is required to determine whether or not what has been taught has really been absorbed and understood, require a group of ten or fifteen pupils in a discussion for effective teaching.

In still other instances the pupil does not need to be under a teacher's direction. He does not need to be taught in groups. He ought to be spending his time learning, reading, writing, memorizing, drilling, or having individual conferences. Group work may not be as necessary for as much of the time as the schedule now makes mandatory.

Each subject-matter field ought to have a structure for its teaching that is appropriate for that subject. Furthermore, this structure should take into account the fact that pupils differ widely in their abilities, in their capacities, and in the pace with which they learn. Some can profitably use long blocks of time and work relatively independently. Others need to be directed more closely. They may even need to be under constant supervision and, in terms of their attention span and interest, require rather short periods of study with more frequent class meetings, in order to obtain the maximum benefit from instruction.

Assumption 7. *It will be possible to obtain the necessary mechanical assistance through the use of data processing equipment to implement a large degree of schedule flexibility.*

The final assumption may appear peripheral, but it is necessary. Experience to date suggests the possibility of using data processing equipment to realize a large degree of flexibility in scheduling classes. The time may be near when basic scheduling information can be listed on cards: the program of studies that each pupil selects—under the guidance of proper persons in the school, available teachers, available rooms, and other special data. An electronic computer may then be used to formulate the master schedule, class lists, teacher assignments, and any other data relevant to the master schedule. Research in progress at Stanford and elsewhere, involving both educators and industrial engineers, gives reason to believe that this may be possible.

# WAYLAND HIGH SCHOOL'S FLEXIBLE SCHEDULING

BY EDWARD J. ANDERSON*

The school should serve each of its constitutents separately—each boy and girl considered as an individual with needs different from those of every other boy and girl. This recognition of individual differences is not a matter for debate, but to design a school which will succeed in meeting the needs of its constituents adequately is still a dream.

The Wayland High School has made and will try to expand this year an attempt to serve its students as individuals. In an attempt to describe how a high school schedules some six hundred students individually in grades nine through twelve, discussion will be restricted to the individual schedules of students and faculty.

The basic group from which we work, the medium-sized group, is composed of thirty to thirty-five students. By combining from two to five medium-sized groups we can provide for large group instruction, and by breaking the medium group down into three small groups of ten to twelve students we are able to have small group instruction.

In our school the basic instructional program for a given subject is presented through one large group, two medium groups, and one small group meeting each week. This will vary—for instance, beginning typing is taught in four large group meetings each week for one semester. Another exception is physics, which has about forty per cent of the instructional program in large group instead of the normal twenty-five per cent.

Each student is also expected to pursue an individual study program and will meet in a tutorial situation with either the medium group teacher or another available member of the teaching team for planning and reporting individual work programs, remedial work, evaluation, etc. We consider this to be one of the most important aspects of the school's program.

* Superintendent, Wayland Public Schools, Wayland, Massachusetts.

A look at a typical English course at Wayland will help to clarify our approach. The teaching team analyzes the subject in terms of units of work and determines what can best be presented in large groups. The members of the English team most capable of presenting the material have this assignment.

LARGE
100 Students

Following the large group meeting the students meet in medium groups with their respective medium group teachers. Here material is

| MEDIUM | MEDIUM | MEDIUM |
|---|---|---|
| 35 Students | 30 Students | 35 Students |

presented which the English team believes is most effectively done in the more traditional manner. Two such meetings are held during the course of the week.

Each medium group is then sub-divided into three small groups. Special attention is given to the ability of the members in the small groups

| SMALL | SMALL | SMALL |
|---|---|---|
| 11 Students | 9 Students | 10 Students |
| 11 Students | 11 Students | 12 Students |
| 13 Students | 10 Students | 13 Students |

so that they might work together effectively. Our experience indicates that the small group requires the most expert teaching and is the most difficult part of the instructional program. This may be due to the lack of training of teachers in small group techniques.

The student meets periodically with members of the English team to plan and report on progress, both teachers and students sharing the responsibility of arranging to get together. A more careful look at the teacher's and a student's schedule will show that there is time during the eight period day for the required tutorial sessions.

The student's individual work program is flexible and he may work in one of the four resource centers, in the library, laboratory, shop, art rooms, theatre, gymnasium, home economics area, or in other available spaces depending upon the nature of the work he is pursuing.

One of the major questions concerns how the teacher spends his time. Using English as an example, we find that a specific teacher has two large group classes and one small group class on Monday; three small and three medium groups on Tuesday; one small and two medium groups on Wednesday; one small and two medium groups on Thursday; and four small and one medium group on Friday for a total of two large, eight medium, and ten small classes during a week composed of forty periods.

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This leaves fifteen periods during the week to be devoted to preparation of materials, team meetings, planning with students, and some leisure time, even a coffee break.

A look at a typical first-year student's program shows him taking (1) English, (2) social studies, (3) mathematics, (4) biology, (5) French II (he had French I in grades seven and eight), (6) beginning typing (offered to all first-year students), (7) physical education (two periods per week), (8) Arts Center (he must spend at least two periods per week in the Arts Center), and in addition he is assigned to resource centers for specific study. In English he has opportunity during every day of the week to meet with from one to three different members of the English team.

This is a brief review of how Wayland High School attempts to meet the needs of the individual student; however, we have not begun to explore the potentials inherent in such a schedule design.

When designing the schedule for Wayland High School the administration and faculty identified and accepted a number of assumptions as being either desirable or necessary in order to make the schedule possible:

1. Not all teaching jobs need to be the same.
2. Teachers need not all be employed for the same number of months during the year.
3. All classes in all subjects need not meet every day.
4. All classes need not meet the same number of periods a week.
5. Students are capable of assuming responsibilities.
6. Teachers are capable of assuming responsibilities and making decisions not usually thought to be the function of the teacher.
7. Learning is more important than teaching and learning can take place without the teacher being present.
8. Substantial improvement must take place in the instructional program and the teacher has the obligation to innovate and invent ways to improve instruction.

These are not all the assumptions, but they may aid a group of teachers to look at themselves critically and design an answer to their own peculiar problems.

Here it must be emphasized that this is a quick look at the way Wayland High School is attempting to provide for the individualization of instruction. No one should attempt to copy the Wayland format, but should innovate and invent in terms of his own school's needs and goals, for each school is, in its own way, as individual as are human beings.

# TOWARDS QUALITY EDUCATION AT NEWTON

BY CHARLES E. BROWN*

Newton is a suburb of the city of Boston. It has an image, to most people, of a privileged community. But Newton is not quite as privileged economically as most people believe it to be. A typical community in many respects, Newton represents all socio-economic levels. We used to say around our junior high schools that the kids came in the front door after having gotten out of a Cadillac while in the back door they came in walking barefoot. It's actually not quite that extreme, but this is a representative cosmopolitan community, representing all walks of life, with a slight skew to the upper socio-economic level as far as New England standards are concerned; a community of 93,000 with high expectations concerning the public schools.

A good many residents of the city are professional and technical people, working in Boston or at one of the universities in the area, or in the new electronic firms that have been developed along Route 128 outside of Boston. The people suppose that the schools will provide a decent education for their children. Expectations are high; interest and concern about the schools is high. It has been a positive sort of interest however, and we find that the community gives the schools a great deal of support, both financial and non-financial.

The Newton System is comprised of 25 elementary schools, five junior high schools, two high schools, one technical high school, and a junior college, for a total of 18,500 pupils. A staff consists of about 1200, one thousand of whom are professional. The budget for the year 1961 is $9,140,000.

Our program is rather difficult to define in a few short phrases because the most descriptive term applicable is the word "flexible." For instance, we have in Newton on the elementary school level, self-contained class-

* Superintendent of Schools, Newton, Massachusetts.

rooms but we also have a form of team teaching. We have again at the elementary school level a general framework for an elementary curriculum, but allow and indeed expect individual variation. The five junior high schools are each different. They operate in the same general environment, but their differences reflect the differences in the staff, the administration, and the community which they happen to be serving. The groupings of students in these five junior highs differ, scheduling procedures differ; each school has been allowed to adapt its program to its own particular needs and interests. In the two high schools, we find more similarity than we do among our junior highs, or among our elementary schools. Undoubtedly this is because our second high school is just a year old and is yet growing in uniqueness from the mother school.

At the high school level, Newton has four basic curriculums with the unstartling labels of one, two, three, and four. Curriculum one is college preparation for what might be called a status, or strenuous, institution of higher learning; about 55 per cent of the youngsters are enrolled in curriculum one. Curriculum two is also college preparatory for those who are going on to a less strenuous or less demanding institution of higher learning, to include junior colleges, nursing programs, and schooling of that type. Curriculum three is a terminal program for those who, at least at the present time, show no indication or desire to go beyond the fourth year of high school. Curriculum four is commercial, designed primarily for the terminal student, though a significant number from curriculum four will go on to some form of higher education. All told, about 80 per cent of the students go on to some form of college, 65 per cent to a four year institution.

The point of view which pervades the Newton Schools is rather difficult to describe. If I had to point to one single feature which allows the schools in Newton to accomplish whatever they have accomplished, that word would be *people*. We have been fortunate enough to attract and to hold first-rate people in the Newton Schools. This more than anything else has shaped the image of the Newton Public Schools. We place great premium, therefore, on the selection and recruitment of personnel—teachers, administrators, supervisors, secretaries, anyone who is associated with the Newton Schools. When we employ a good person our point-of-view is to get out of his way as much as possible and to allow him to operate as he is able to. This policy is particularly applicable to principals. The principal in Newton has autonomy, freedom to adapt programs to the needs and interests of his students, his staff, and to the variations in the communities that these schools serve.

This philosophy of organization gives a working advantage, for it provides a middle-management strength. Providing the units are operating well, they breed the imagination, the freedom, and the courage to make

decisions that cannot always rest with central staff. This builds strength where it is needed most, at the action level. From this feeling of autonomy arises many of the innovations that have come out of Newton.

There is, also, a tradition at Newton that is related to people more than anything else. We try to find ways of doing better that which is already being done well.

The schools and the community also place high value on quality in education. The schools attempt to do more than superficially shuffle things in order to give the appearance that change has taken place. Shuffling is not accepted. We have too many who are concerned with improving education, who are concerned with what goes on in the classroom, in the all-important relationship between the teacher and the pupil.

This concern for quality has created a desire on the part of the staff to lead all to greater concern with intellectual development, to the point where students ask "why" and "where" and say "I don't agree," where everyone is kept a little bit off balance, where people try to get beneath the surface of things so that the teacher is constantly kept on his toes. The pupil knows that he is respected for what he is, that his ideas are important, that when he expresses an idea, it will be listened to with respect because his importance as an individual is respected. This sets the tone, I think, for everything that happens in the schools.

Looking toward the future, we are interested in six elements in the public schools of Newton.

First, we are interested in curriculum, the scope and the sequence of what is taught. This is certainly the starting point.

We are also interested in how we group youngsters for the learning process. We talk about homogeneous grouping. But as someone recently said the only really homogeneous group is one person. The more we know about psychology the less certain we are that one person is homogeneous. The grouping of students is terribly important to us.

Once grouped, how does one develop and use a staff to accommodate these various arrangements of students? Certainly the growth and the proper utilization of teachers is most critical to quality education.

The fourth element is time. When should a youngster begin his formal education? Should all youngsters come to school at the same time and leave at the same time? How about summer? What do we do about using this valuable time in a youngster's life? How about the facilities, the element of time in using the school plant? It always strikes me as strange that society allows the youngster to be almost any place in the late afternoon or evening, whether it be the corner drugstore, the beach, or just "out." But the library is off limits. So this element of time is important to school.

The fifth element is space; how do we arrange spaces for optimum learning?

Finally, there are the materials, the instruments for learning. This is becoming increasingly a problem to us. When students are moved unconventionally, and when the staff is utilized differently, one needs different materials to work with. All too often they are not commercially available, so they have to be made locally. We now spend more time developing curriculum materials for our particular needs than in almost any other pursuit.

These six elements describe generally how we take a hard look at what we are doing at Newton. It was out of this general climate that our interest in data-processing grew for good reasons. First, we needed help in evaluating some of the things that we were doing. We found that through the use of data-processing equipment we could do this more quickly and more efficiently. We needed help in gathering and sorting these data quickly and accurately.

Also, because of great demands placed on staff, a problem typical to all schools, we needed ways of relieving them of non-teaching duties. In addition, we needed help in identifying possible areas for further study. Finally, as we became more involved in new courses, new ways of grouping students, and of using spaces, and new ways of differentiating the teacher's role, we badly needed help in scheduling these various elements into an operating school program.

It was at this point that we added a staff member to aid us in developing data processing notions as they apply to an operating school system. Our program is now in its second year and we have already gained much valuable assistance from the data processing operation. Recently we joined Harvard University's program to improve school data processing in the New England school systems. Thus we definitely are committed to expanding our base of operations in this area and are confident of the benefits that will accrue.

# APPROACHES TO FLEXIBILITY AT CUBBERLEY SENIOR HIGH SCHOOL

BY JAMES LAURITS*

For the past three years, we have tried every twist and turn in conventional scheduling. We did not wish to adopt a radically new system for the whole school. Instead, we hoped gradually to transform our schedule into the complicated form which would suit each department in a peculiar way.

*ROTATION OF PERIODS:* The periods come at different times for each day of the week. The A-block might be 8:00 on Monday, 9:00 on Tuesday, 10:00 on Wednesday, etc. That "difficult" class does not arrive each day at 2:00 in the afternoon. Students and faculty like the many advantages of the rotating schedule. The big disadvantage: it is in direct conflict with programs which give some students a shortened school day.

*LENGTH OF PERIOD:* Many subjects need longer periods of instruction, and we provide 110 minutes for any such request: as in chemistry, photography, mathematics, shorthand, painting, industrial arts, home economics. The subjects meet three times a week, usually a 2-2-1 pattern. The California State Department of Education gave us permission to try physical education on the same pattern, adding greatly to the schedule's flexibility.

*INDIVIDUAL STUDY:* Mathematics provided a testing ground. First, we developed comprehensive lists of special books in mathematics, and created an exciting library. Next, some classes began to meet only four times a week. Students went to the mathematics library once a week, with instructions to browse, follow their interests, explore new mathematical subjects, report to the class on their discoveries. The enrichment program will now be adopted by other subject departments. The high school has never had study halls anywhere in its program.

* Principal, Cubberley Senior High School, Palo Alto, California.

*ADDING A SUBJECT:* For the abler students, we tried reducing most of their subjects to four times a week, and floated the physical education classes through the fifth-day periods; in effect, seven subjects within the six-period day. Students liked the schedule. We abandoned the idea because some teachers felt that four weekly meetings were too few. Teachers of English, mathematics, and science became nervous about the quality of their "reduced" courses.

*ENRICHED PROGRAMS:* After surrendering the squeeze of seven subjects into six periods, we decided to extend the school day for the abler students and for any who desired more time. About one-quarter of all students now have seven subjects instead of six, taking either English or physical education in the last period of the day, 2:40 to 3:30 p.m. The seven-period students are told to select electives which do not have homework. We do find that the majority of these students take five academic subjects in each year. The extended day has strengthened our school by placing the abler students in the elective subjects. From auto shop and drama to business law and foods, all are enriched.

*TEAM TEACHING:* The social studies department divides the senior class into five groups of one hundred each, and each group is taught by four teachers. The team includes two intern teachers in the Stanford program. The seniors meet once or twice a week in the large groups, but the schedule changes each week and is planned by the team about ten days in advance. The "sections" of each group number 25, and there has been student resistance to breaking the section into smaller groups, say 10 to 12, since some students feel they would miss valuable discussion by their section-mates. In other words, determine the size of your discussion section and stick with it.

To date, we have been led to feel that students of low ability must continue in the large-group instruction and that such participation means much to them and to their attitude to learning. In fact, the teacher of the mentally retarded sits with her students in one of the large groups. The smaller sections are used as a flexible system of ability grouping. The five large groups use a gross grouping by ability in order to separate the extremes.

All students in chemistry are taught by a team of three teachers, and the large-group here numbers 60. The schedule will be changed from one week to the next.

Mathematics will now try a schedule that looks more rigid on paper. The student will meet twice a week in a group of 100, taught by four teachers. Immediately following the large-group presentation, the student attends his section meeting where problem-solving and discussion takes place. Here, the team pattern and the double period are used at one time.

Music classes are taught by two teachers. The scheduling of several

groups and ensembles in a class varies with the season or with practice needs, as well as with the day of the week.

Our studies in scheduling have been exciting and fruitful. We will continue with new patterns and with expansion into other subjects. At the moment, we doubt that any one schedule pattern will suit all parts of a school or all students. However, we now need THE MACHINE, since our pattern is so complicated that one cannot readily see the best master-schedule form, and counselors must tailor the program individually for most of the students. A two-dimensional subject matrix is a conflict chart of sorts, but we now need the three-dimensional and perhaps the seven-dimensional matrix. Then, we'll give the machine the schedule features (limits) we desire and, from the matrix, the great machine will give us several master schedules. I say "several" because we must retain something for the principal to do. Of course, he *could* begin to work on personnel administration, on school organization, and on curriculum, but these are difficult matters and playing with the schedule is easier by far.

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## FALL 1961 SCHOOL ENROLLMENT

When the 1961-62 school year gets under way, the number of students expected to be enrolled in all kinds of schools from kindergarten through high school will be 45,000,000. This will be an increase of 1,100,000 over the previous year and the seventeenth year in an unbroken upward trend. In long-term perspective, this picture may be made graphic if it is understood that the past decade has seen an enrollment increase of over 16,000,000—about equal to the population of New York State.

The most dramatic rise will be in the number of high school students, and a continuing important trend is the more rapid increase in enrollment in Roman Catholic schools. In 1950, all the parochial elementary and high schools enrolled just over 3 million youngsters; this year, the total is estimated to grow to over 5.4 million.

In the high schools, grades nine through twelve, enrollment in all types of schools is expected to reach 10,800,000, an increase of 700,000. Public schools are to enroll 9,500,000, or 600,000 more students than last year. Roman Catholic parochial schools expect 933,000 students, a gain of 53,000. Allowing for an enrollment of 100,000 in the "special schools," such as those Federally operated, this leaves about 267,000 students enrolled in the various independent secondary schools. The adjusted figure for last year was 220,000.

—*New York Times*, September 3, 1961

# FLEXIBLE SCHEDULING AT RIDGEWOOD HIGH SCHOOL

BY JAMES E. SMITH*

Ridgewood is not a conventional school. Conceived and authorized by its district board of directors in 1959, the plant was constructed and in operation by fall, 1960. From inception of the idea of building their own high school, Norridge people, sandwiched between Chicago and large suburban neighbors, paid no heed to "what the neighbors were doing." The sole criterion for decisions about their school has been, "What will best meet the needs of OUR students?"

As a result, Ridgewood High School is a sound, well, and reasonably constructed flexible plant with space for large group and small group instruction. Team teaching, involving large groups, seminars, laboratory work, and individual study projects, is conducted throughout the curricular offerings. Scheduling of students has been on a modular basis with particular attention to individual programs. In its first year of operation Ridgewood has become one of the "growing edge" schools of the U. S. While Ridgewood teachers and administrators insist that they have no "magic formula" to transmit to other districts and point out areas of weakness as well as strength in their program, the school serves well to illustrate what can be done when preconceived notions and traditional concepts are *not* considered foremost in development of educational specifications for buildings and curriculums.

First consideration at Ridgewood was for the curriculum and how best to relate individual students to proper course offerings. A bare outline of courses on paper makes Ridgewood appear to be essentially the same as any other modern, comprehensive high school. However, Ridgewood decided that they wanted to utilize the time of the staff and students to better advantage than is the usual case in a conventional school. For each department of the high school (i.e., English, Mathematics, Phys-

* Administrative Assistant, Ridgewood High School, Norridge, Illinois.

ical Sciences, etc.) an Instructional Group was established. This group consisted of a senior teacher and a junior teacher, both certificated, a teaching assistant or assistants who are non-certificated subject specialists or teaching interns, a clerical assistant and a general aid. The school audio-visual and library persons are ex-officio functioning parts of each group. Together the instructional group plans the total program and effects its presentation and evaluation.

To house such an operation on a school-wide basis, space modules were built around large group lecture rooms. Adjoining each large group room are small conference rooms which, in turn, have their own flexibility. They can be used for relatively large "small groups" (up to 16) or they can be divided by visual partitions to handle half as many or fewer. Conference rooms are built adjacent to each other with a common wall containing a wide window which allows one teacher to be available as resource-supervisor for as many as four groups at a time if so desired.

Over-all coordination of the curriculum is achieved by grouping all offerings into two departments: a Mathematics-Science and a Humanities Department, with senior teachers as co-chairmen of each department.

Scheduling is a coordinated enterprise of all the staff working with a 20-minute time module. In general, large group meetings use two time modules. Small group and individual study time allocations may vary from one to four modules, depending upon subject, specific projects under way, and individual needs or abilities of students. Large group meetings are usually preceded by the seminar meetings which means that each class is offered several times in order to allow for maximum student programming flexibility. Students are slightly grouped by ability in arranging seminar groups. The top 15 per cent and the bottom 15 per cent are siphoned off for accelerated and remedial work respectively. Other groups are randomly arranged.

Individual study offered a maximum opportunity for flexibility. What was at first considered the disadvantage of a few inescapable single module time units for individual students was turned to advantage by utilization of the 20 minutes for practice, refresher, or other minor tasks of importance to the student and which would not usually be accomplished because they were not worth a full period. These tasks included such things as typing practice, pre-lecture review reading to get into a proper frame of reference, last-minute preparations which could not be done at home. It was found that most students can use small blocks of time as well as large blocks when such utilization is planned and the student carries individual responsibility for handling it.

Study halls presented a particular problem and the problem was solved by a unique manipulation of the time module. As originally set up, students and teachers changed in study halls at the same times, lead-

ing to the usual confusion of settling down after the bell. This was changed so that groups of students entered and left at different module intervals and teachers entered and left *between* module intervals. During period breaks, two teachers would be in the study hall many times on overlapping time segments. At no time did ALL students enter or leave study hall together and at no time did teacher changes occur while student changes took place. Thus, study hall became a continuing quiet atmosphere into and out of which small groups of students merged and faded without a large group commotion.

Among difficulties encountered, Ridgewood teachers rank individual study as the most perplexing as well as potentially most fruitful. Results during the first year were something less than hoped for. They hypothesize that this may be partly a function of the newness of the program to the students and lack of specific instruction on *methods* of individual study. They hope that additional experience plus specific instruction in reading techniques, research methods, and organization of study time will lead to improved performance in coming years.

Ridgewood would be a unique institution if only for the fact that it progressed from initial planning stages to completion and function in little over a calendar year. It has also demonstrated that much can be done with a high school program when all but basic objectives are disregarded. In their case, Ridgewood personnel considered the instruction of students via sound psychological principles to be the single important objective of their school. To this end they developed an instructional team for each broad subject area and built an instructional center in which this team could operate effectively, providing such supplementary aid as needed in the form of laboratory space, library, audio-visual help. Flexibility of space and time was emphasized in order to make maximum utilization of individual student and staff time in school. The entire schedule was organized on a 20-minute time module. Intercommunication among the staff was necessarily at a high level in all aspects of planning, presentation, and evaluation. The first year of operation has resulted in even greater enthusiasm for their scheme among Ridgewood personnel as well as recognition of minor weak points for which remedial steps have been planned.

# A BASIS FOR FIRST STEPS IN FLEXIBLE SCHEDULING

BY M. DELBERT LOBB*

The major task in secondary education is improvement of the effectiveness of instruction. This is not a new challenge. It is at all times the central obligation of teachers and administrators. The direct route to such improvement is through better utilization of the staff. This is to say that the greatest gain in the quality of education can be realized by providing the opportunity for personnel to make the best possible use of professional skill and time.

The master schedule sets the pattern of relationship among teachers, pupils, and curriculum. Therefore, it must be constructed so as to allow the kinds of situations and experiences which will bring best results. During recent years there has been increasing interest in investigation of schedule modifications. Fremont Union High School District, like some others, has begun to try out schedule changes along with its team teaching program. These changes are permitting more teachers to meet students in groups of various sizes for differing purposes and to redistribute professional time for more adequate preparation and planning. The advantages observed in the Fremont District and other school systems indicate that there probably will be wide acceptance of flexible scheduling. Pioneer work at Stanford University shows that electronic data processing will facilitate the solution of highly complex schedule problems. It may become possible to frame almost any kind of organization of time and activities.

When taking the first steps toward flexible scheduling, educators should give attention to several areas concurrently. These are the philosophical, psychological, instructional, and supplemental bases for decisions.

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*Philosophical*

1. Flexible scheduling should not be approached as a "new cosmetic for an old face." Blemishes of the traditional patterns of organization should not be just "painted over."

2. Each school district must establish its own rationale for staff utilization. It probably will develop along the following lines: The basic aim is to improve instruction. This can be brought about primarily through the improvement of teachers or, more appropriately, through providing the setting in which teachers can grow professionally and make the best use of their talents. To do this requires continued analysis of the teaching function by all who are involved. Then organization for the optimal utilization of staff must be designed.

3. Perhaps the shortage of competent teachers has been overemphasized. Not that it doesn't exist, but because it takes on the aspect of hopelessness. The view that the competencies of the "master" teachers should be spread over a broad area of influence is neither as functional nor as optimistic as the approach which relies on upgrading the capabilities of all individuals and providing incentive and occasion for professional interaction.

4. Educators must accept and foster an experimental philosophy. The attitude of research should be more than just a willingness to try out some new technique which is receiving national attention. Investigation should be an integral part of the educational program, and it should be conducted in a scientific manner. Every teacher is capable of this kind of study in some measure. It is necessary that full administrative support be given to those who accept this obligation.

5. Flexible scheduling is part of a concept, not a specific pattern. It is associated with the concept of conservation. Conservation, in this connection, means the liberating of educational forces and potentials through efficient use of human and material resources related to teaching and learning.

*Psychological*

1. In taking first steps, it is important to be alert to the natural fears of teachers. There will be resistances to any program which prescribes determination of remuneration on the basis of deserts and merits. Some teachers fear their own inadequacy, real or imagined, more than anything else. Most will be concerned about new ideas which they suppose will cause a diminishing of opportunities to be educationally creative.

2. One of the struggles in secondary education is to substitute the security of mobility for that of stability. It becomes more and more difficult to keep the fences of one's educational life mended. It is absolutely essential that teachers be comfortable with change. Those persons, who

presently make use of a wide range of modern techniques known to be successful, are characterized by an adaptability which will help them adjust to subsequent innovations.

3. There is need of continued effort to understand the learning process. This requires action by individuals and groups within school districts. Outmoded procedures are not discarded until there is a rise in the level of sophistication of knowledge about how learning occurs.

*Instructional*

1. In almost all, if not all, academic disciplines there is a movement toward conceptual approaches in curriculum. In instruction, there will be increasing emphasis on interrelating process and product. This alone puts a different complexion on the use of professional and student time.

2. The necessity of identifying and analyzing educational tasks becomes more and more apparent. This can lead to elimination, realignment, and re-assignment of the jobs of teachers and schools.

3. Homogeneous grouping of students, generally by ability, needs close scrutiny. In any case, grouping should be made to serve the purposes of education rather than education being made to serve grouping. The essential point is that homogeneous grouping accomplishes nothing in itself. The teacher must realize that he still has the same task of individualizing instruction.

4. There is danger in fragmentation of the curriculum. Establishing a new course whenever there seems to be a new need can lead to a shattering of curriculum which imposes severe restrictions on schedule-making and utilization of staff. There must be a counterbalance of integrative pressure.

*Supplemental Bases*

1. In considering personnel resources, wide vision can be helpful. Schools have only begun to tap the reserve of non-professional assistance. It would be profitable to examine areas of possible contributions by students, classified personnel, community persons, universities, and other agencies.

2. With regard to materiel resources, it takes an intentional effort to keep abreast of new developments. A school must give serious consideration to programming for auto-instruction, electronic data processing, television and other electronics equipment, and all manner of audio-visual materials.

3. The housing of activities of teaching and learning is receiving its share of attention. A throttling influence in many ways in the past, school plant planning today shows freshness, imagination, and functionality. Flexible scheduling necessitates construction of buildings which accommodate groups of various sizes and purposes.

Certain considerations in taking first steps toward flexible scheduling merit some emphasis. Team teaching is an approach which provides entrance into a long-range program for better utilization of staff.

Key concepts are involvement and commitment. As many persons as possible should be involved in planning and implementing first steps. There must be a high degree of commitment to the rationale and the development of program.

Expectations must be reasonable. Flexible scheduling will not solve all of education's problems. Also it should not be used by individuals to secure special privilege as the price of participation.

There is a multiplicity of patterns. Actually, every school should be unique and not a copy of some other program. It is worthwhile to study as many situations as possible, but a specific plan should be developed locally.

In taking the first steps toward flexible scheduling, it is advisable to work on a number of facets of education concurrently. The size of the step depends upon the fortitude and commitment of the school principal and his staff.

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## AFTER HIGH SCHOOL

By the end of 1960, nearly half of the June, 1960, high school graduates were attending college, and about three-quarters of the rest were working or looking for jobs. According to a special labor force report published last week by the United States Department of Labor, even though the job market was "affected by some economic slowdown, 85 per cent of the 1960 graduates who entered the labor force were working by October, and the other 15 per cent were actively seeking jobs."

The survey reports that the girls were concentrated in clerical and sales positions, and about one-third of the men became semi-skilled workers. Although the picture is similar to that of 1959, there is some indication that more young men this year were employed in jobs which tend to pay lower wages.

Increases in the number of new workers who did not finish high school create special problems, the report said. "The economic cost of not having a diploma" is represented in the "lower skill of the jobs compared with high school graduates, as well as the smaller proportion of jobs providing a full week's work."

Of the high school graduates, 54 per cent of the men were enrolled in colleges, compared with 38 per cent of the women. One out of every four of the college students was either working or looking for work.

—*New York Times*, Sunday, July 16, 1961

# MACHINE PROGRAMMING AT HUNTINGTON BEACH HIGH SCHOOL

BY SCOTT FLANAGAN*

Huntington Beach Union High School District is located on the coast approximately 15 miles south of the city of Long Beach. For many years it was a wealthy high school district; it is no longer wealthy. The district now has two high schools, and is in the process of building a third. Forecasts indicate that nine will be required by the time the district reaches saturation.

The district has used IBM equipment for the past two years. Without exception, everyone connected with the district appears to be highly pleased with the operation of this equipment. The method of programming now used is only practical for a district of small or medium size, two or three high schools. The advantages of the techniques offered by IBM make possible accurate academic groupings and an even distribution of students in each class.

We do not claim that what we are doing is unique, but it is highly successful for us. Instead of having manually to program each student into each class, the machine does this programming and scheduling in a rapid and efficient manner.

Huntington Beach High School has one counselor for every 350 students. During the school year the parents of 9th grade students are invited to the counseling offices for a conference, at which time the counselor, parents, and student go over test scores, grades, interests, and teacher evaluations in order to set up an educational plan for the next three years. Then in each of the subsequent years, sometime during the spring, the counselor contacts the students in small groups. At this time the educational plan is re-evaluated. The counselor codes the subjects

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which the student is to take for the coming school year and groups the student into appropriate ability levels. We have three ability groups for the academic subjects.

The forms containing the educational plans are forwarded to the IBM Department where they are key-punched and a preliminary tally is developed; this tally shows totals of each subject by ability group. The program cards are key-punched with codes in numerically ascending order into the six subject areas of the cards. This sequence is needed later for setting up the conflict form. Example:

002-2 = English 2, ability 2
102-1 = World Hist., ability 1

We also list a student's program on a pre-registration worksheet. This appears in coded form for the counselor's use in making subsequent program changes which are sent periodically to the IBM Department.

The obvious advantage of having a tally at this time is for purposes of employment of new teachers and budgeting forecasts. The principal of each school will submit to the IBM Department specific recommendations as to the number of sections to be offered in each subject and each ability group, and the maximum class size which he prefers, or any special considerations as to teacher assignments (a particular preparation period for a teacher, a coaching assignment in the afternoon, or any other unique situation).

Now the IBM Department possesses all information necessary to develop a *Tentative Conflict Schedule.* After the incoming 9th graders have been programmed and the existing students have been brought up-to-date on their educational plan forms, the information on the cards is used to set up a tentative conflict schedule. This conflict schedule is, in my opinion, the greatest advantage IBM provides the principal. Most administrators who have developed a master schedule at one time or another will recall the hours it has taken to develop a conflict schedule by himself. With the use of IBM this conflict matrix form is developed in approximately one day, where it used to take at least two weeks.

By the use of machines, the program cards are searched. All single section subjects are counted and the totals are entered on the conflict matrix form. Then further search is made of these selected groups for additional single subjects; these totals are posted in their appropriate boxes on the same lateral. For this process, the condition of working in a sequential manner from left to right on the conflict form and from Area 1 to Area 6 in the program cards must be maintained. The above process is completed for double section subjects and also any other for which there is some doubt as to the placement. Then the conflict form is cross-referenced to make period assignments where the least amount

of conflict exists, and transfer is made to the preliminary tally report. All periods are assigned on the preliminary tally report and the ability group assignments are staggered by required subjects and by grade level to insure proper filling of classes later on. Now the class master cards are key-punched. The last step is to tabulate the student load distribution report showing the estimated class size by period, subject, and teacher. The next step is to list a tentative master schedule.

Student period assignments are made after the master schedule has been checked in every detail. The teachers have been hired, changes have been made. Then IBM punches a period assignment code into the student program cards. This is done by working with a group of period assignment master cards, where by working from least offered to the most offered subjects, each class is filled completely before going on to the next one. Then the program cards are sorted and blocked between the period assignment gang cards and these are hand pulled, then sorted on the six period assignment columns to search for availability of period. If, during this process a program card falls behind a colored gang card, it is analyzed to determine availability in other periods. If none is found, it becomes a conflict and is held out of the processing and later listed for a program change. Then the program cards with period availability are placed in equal groups behind the respective gang cards; periods are gang-punched in the designated assignment columns in the program card. By following an iterative process the cards are sorted and gang-punched until all period assignments have been made in each of the subject areas of the student's program card.

We have now processed all scheduling data into the student's program card; this information is taken out of the program card and expanded into the class card, one for each of the subjects a student is taking. These class cards are used to print the student's program; other use of the class cards is made by the teacher for mark-sensing grades. The class and grade cards remaining after seats have been assigned to the existing student body, are sent to the schools and are used for program changes and new enrollments after school is in session.

In addition to registration and programming, Huntington Beach Union High School District uses the data processing equipment to send out grade reports, class lists, and for permanent records, attendance accounting, scholastic deficiency notices, bus stops, and locker numbers.

The following suggestions are offered for districts wishing to install IBM equipment:

1. Obtain a trained IBM technician.
2. Visit other schools which have installed IBM equipment.
3. Start with few operations.
4. Plan, anticipate, plan.

# MACHINE ASSISTANCE FOR CONSTRUCTING THE HIGH SCHOOL SCHEDULE: AN INDUSTRIAL ENGINEER'S REPORT

BY ROBERT V. OAKFORD*

Various aspects of this subject have been discussed by Appleby, Blake, and Newman (1), Bush, Caffrey, Oakford, and Allen (2), Holz (4), Pack, (5), Paumen and Abendroth (6), the Service Bureau Corporation (7), and Sherman (8).

In an effort to crack this difficult problem the Secondary Education Project at Stanford University is attempting to determine how electronic data-processing machines can be used in formulating the high-school schedule. Supported by a grant from the Fund for the Advancement of Education of the Ford Foundation, the Secondary Education Project is a five-year experiment to improve the quality of secondary education. Part of the project is devoted to experimentation in curriculum and use of staff in selected high schools. The work reported here has been undertaken to help develop more effective and more flexible scheduling procedures. The undertaking is important for two reasons: first, if machines can do work as well as, or better than professional talent, which is in short supply, we would be unwise not to conserve that talent. Second, the full-scale application of the principles of more flexible scheduling seems impossible without a significant break-through in the handling of the many variables that have thus far escaped or proved to be beyond the compass of school administrators.[1]

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[1] John G. Caffrey, director of research, public schools, Palo Alto, California, participated in the study of the adaptation of electronic computers for school schedule construction in addition to the Stanford University participants Dwight W. Allen, acting assistant professor of education, Robert N. Bush, professor of education, Robert V. Oakford, associate professor of industrial engineering, and Charles R. Pack, graduate student in industrial engineering.

When Allen first asked Oakford if it were practicable to use electronic computers to generate school schedules, the latter replied by asking if Allen could furnish a detailed description of the logic of schedule making. Further investigation indicated that the development of school schedules is not a routine logical procedure. Instead, it appears that it is more of a "cut and fit" procedure that involves many compromises and depends heavily upon the experience and judgment of members of the teaching and administrative staff. Although there is a great deal of detailed work involved in the cut-and fit procedure, the school executive is reluctant to delegate to his clerical staff the responsibility for adjudicating the many compromises. Consequently, senior members of the administrative staff are heavily involved on the detailed work of the cut and fit procedure.

E. L. Grant[2] succinctly defines a decision to be a choice between alternative courses of future action. In many practical situations, it is observed that alternatives may be quantified realistically and that the decision can be based upon the outcome of a comparison of two numbers. Such decisions will be referred to as *logical decisions*. As an example, consider the decision as to whether room X has sufficient seating capacity to accommodate the enrollment in class Y.

Frequently, the alternatives involved in a decision cannot be defined realistically in terms of numbers alone. Instead (or in addition) there may be intangible values that must be weighed in making a choice between alternatives. Such decisions will be referred to as *judgment decisions*. As an example, consider the decision as to whether subject Z should be offered in several sections with small enrollment or in a single section with large enrollment.

Judgment decisions and logical decisions both play an important role in the construction of a school schedule. The administrator will properly wish to retain responsibility for making judgment decisions, but he should welcome the opportunity to delegate the execution of logical decision processes to clerical assistants or to a machine. To effectively realize the latter objective it will be necessary for him to map a strategy that clearly distinguishes judgment decisions from logical decisions.

The concept of a strategy may be illustrated by the hypothetical case of the executive who is expecting a phone call but must be away from his office when the call is received. His secretary will receive the call so he leaves the following instructions with her—If Mr. Brown calls and states that condition A is satisfied, tell him to take action B. If instead, he states that condition C is satisfied, tell him to take action D. If he states that neither condition A nor condition C is satisfied, tell him that

[2] E. L. Grant, *Principles of Engineering Economy*, 4th Edition, New York, Ronald Press, 1961.

I will call him when I return to my office. This simple example illustrates that the executive has not really delegated to his secretary the responsibility for deciding the action to be taken. Instead the executive has defined the possible outcomes of the phone conversation, and has made the decision for each outcome in advance. The secretary is responsible only for determining what Mr. Brown states, and then following instructions. In short, the executive has decided upon his strategy in advance and has delegated to his secretary (and to Mr. Brown) the responsibility for executing the strategy.

To define a strategy for constructing school schedules, it will be necessary first to identify all the choices that must be made. For each choice, the decision process must be defined. If the definitions are precise, it should be possible to delineate clearly between logical and judgment decisions. Finally, it will be necessary to describe the action associated with each possible choice. Once this has been accomplished, the administrator can determine how to delegate responsibility for execution of the strategy.

It should be kept in mind that the primary reason for developing the school scheduling strategy is to permit the educators to further their educational objectives. These appear to be stymied at present because of the difficulty of constructing schedules that are more complex than conventional schedules. If it is assumed that a strategy for constructing a school schedule can be defined, the decision whether or not to introduce machines in the execution of the strategy would appear to hinge primarily on the relative costs of machine processes and manual processes.

Computers are currently being used successfully to solve problems that are comparable in magnitude and complexity to that of constructing a school schedule. This fact does not of itself guarantee that a strategy can be developed that will permit their adaption to the solution of this problem but it does give a basis for optimism.

It is known that computers can be programmed to make logical decisions and perform actions involving arithmetic operations. It is quite certain that the construction of a schedule for a school with an enrollment of 2000 students will involve a rather large mass of data and an enormous number of comparisons and arithmetic operations. It follows that any computer that is adapted for this function should have a large memory and probably should be very fast. These factors indicate that the hourly rental rate for such a machine would be relatively high—e.g., $400 to $600.

With such a rental rate, it seems intolerable that the machine process should be interrupted for judgment decisions. Consequently a strategy would be required that clearly separates the judgment decisions from the logical decisions.

The basic data required for the construction of a school schedule are descriptions of the following.

a. The set (group) of courses to be offered; with a specification of the structuring of each offering and of other special restrictions as to rooms, teachers, and hours.
b. The set of student programs with a specification of special restrictions for each.
c. The set of teachers with a specification of special restrictions for each.
d. The set of rooms with a specification of capacity, special facilities, etc.

Many judgment decisions will be required in the definition of these data. Once the data are defined and translated to a highly stylized notation, it appears likely that a computer can be programmed to construct a schedule by executing a strategy that involves no judgment decisions. Once the schedule is constructed the results would be translated into tabulations of class lists, student schedules, teacher schedules, etc. The users should anticipate a requirement for standardization in the form and terminology of these reports, but they need not fear complete regimentation.

It would be desirable to be able to determine in advance whether or not it is possible to construct a schedule that would satisfy all conditions specified by the data. However, this information would not be very valuable without a procedure for constructing such a schedule. At the present time, the principles of constructing school schedules, are not sufficiently understood, if indeed they exist, to provide either of these features.

Instead, the state of the art permits only the introduction of techniques for facilitating the construction of school schedules. Here one encounters the two-step approach and the one-step approach to the problem. In the two-step approach, the timetable for class meetings is constructed in the first step, then the students are assigned to classes in the second step. In variations of this approach, teacher assignments and room assignments are performed in either or both of the two steps. In the one phase approach, all assignments are made as the schedule is cast.

Also one encounters variations in technique depending upon whether the course structuring requires single section or multi-section offerings. It should be pointed out that the term "ability level sectioning" really refers to different course offerings that must be distinctly identified because students cannot be arbitrarily shifted among the various classes in such offerings. The term multi-section offering, as used here, indicates a replication of offerings when the enrollment exceeds the specified class size for that offering.

We are developing techniques for the one phase approach to the construction of a school schedule involving multi-section offerings. Success in the development of these techniques will depend largely upon our ability to define criteria that are intuitively appealing and effective for:

a. Selecting the next section to be scheduled.
b. Selecting the teacher and the room to be assigned to the section.
c. Selecting the periods at which the section is to meet.
d. Partitioning the course enrollment into sections for class meetings.

Since the present state of the art does not guarantee that the correct choices will be made when a course enrollment is initially sectioned, criteria and techniques are required to resolve apparent conflicts in student assignment as they occur in schedule construction. This is basically a matter of transferring students between sections, but it may lead to sections that vary in size.

After the schedule is cast, judgment decisions will be required if sections result that are either too large or too small, if a student's program cannot be satisfied, etc.

The papers cited in the bibliography report on techniques that have been developed for adapting machines to the construction of school schedules. Appleby, Blake, and Newman (1), and Paumen and Abendroth (6), report on procedures for construction of schedules involving single section offerings. Blakesley (3) and The Service Bureau Corporation (7) report on the adaptation of computers for the second phase of the two phase approach. Pack (5) reports on an experimental (computer) program for the one phase approach involving multi-sectioned offerings and providing for resolution of apparent conflicts.

Appleby, Blake, and Newman suggest intuitively appealing criteria for selecting the next section and for selecting the periods at which the section is to be scheduled. They have tested these criteria in constructing a schedule for a British school that appears to correspond to our elementary school.

We can report encouraging results in our attempts to adapt variations of these criteria to the manual construction of schedules involving sectioned offerings. We believe that we have developed criteria for partitioning enrollment into sections. However, we have not yet tested these criteria sufficiently to report on their effectiveness. If this technique proves to be consistently as successful as it has in the tests made thus far, it will be a distinct improvement on Pack's approach.

We believe that optimism regarding ultimate success in the adaptation of computers to this problem is justified. The optimism is based not only on the success that has been reported thus far, but also on the growing interest in the problem and the availability of funds to support research.

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## TAKE-OFF

The Midwest Program on Airborne Television Instruction will go on the air from the air tomorrow with its first full schedule of educational programs. The taped programs will be televised for six hours a day, four days a week, from an airplane circling at 23,000 feet over central Indiana.

The broadcasts will be viewed by nearly 1,000,000 students in thirty elementary and high schools. The sponsors of the project hope that student participation will increase to 2,000,000 by the end of the second semester in June.

The program, which is based at Purdue University, Lafayette, Ind., has a potential audience of 7,000,000 students in 13,000 schools. The DC-6 flying studio will transmit a TV signal that will reach into six Midwestern states within a 200-mile radius.

During the fall semester, sixteen series of telecasts will be transmitted on a regular weekly schedule, with new courses to be added in January.

The Ford Foundation and private industry are supporting the program. The M.P.A.T.I. was formed to choose the curriculum and recruit teachers for the program. The Westinghouse Electric Corporation equipped the planes and provided technical knowledge and assistance.

—*New York Times*, September, 10, 1961

# DATA PROCESSING FOR STUDENT SCHEDULING: AN IBM APPROACH

BY B. H. WULFF*

For more than twenty-five years data processing techniques have been applied to the many administrative tasks that are an essential part of the educational system. Only recently, however, have these techniques been directed toward the voluminous job of student scheduling.

The recent interest in electronic scheduling is partly due to the development of procedures which can be adapted by the schools to the smallest data processing installation or the largest commercial computer systems. In either case, the approach takes advantage of the flexibility of the punched card—only the speed and degree of machine decision-making vary. Whether a small installation schedules 50 students per hour or a high-speed computer processes the data at the rate of 1000 or more schedules per hour, the results are fundamentally the same. Each produces the necessary records and reports, reduces the number of scheduling errors, minimizes schedule conflicts, and assures an even distribution of class loads.

An optimal plan takes into account the availability of facilities and teachers as well as the needs of the students. To meet this objective, only two basic punched card records are required, a student program card and a master class card. These two documents will produce a master program, schedule the students, handle registration, prepare class lists and, as by-products, provide attendance records and grade reports.

The automatic scheduling process begins with the student program card. This card contains test results and other pertinent information which can be used by the counselor to assist the student in the selection of courses. The student's course requests are recorded on the card and

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later key-punched. All student program cards are then processed by machine to determine the number of requests for each course and the number of sections to be offered. Conflicts in the scheduled time periods for any course are indicated by a subsequent step in the procedure. From this machine-generated data, the master program is developed and a list is automatically prepared of all students with potential conflicts in their programs.

Once the master program is completed, the second basic document, a master class card, is prepared for each course. This card includes such information as teacher identification, the room number, the period, and the maximum and minimum size of the class. Both the student program cards and the master class cards are used in the actual process of scheduling students into their requested courses.

There are three basic approaches to the student scheduling operation and varying plans for each. First, in the "bin" plan, the student's program is developed by pulling prepunched and numbered class cards from a file and then machine processed. With a unit record system, the job is accomplished by scheduling each class in a priority sequence. The third approach involves the use of a medium or large-scale computer. Programs are available for both the IBM 650 and 7070 computer systems which are generally applicable to any school system regardless of its size or scheduling problems.

All of these approaches prepare, by machine, the completed student program and class lists. The fact that each of the courses selected by the student are represented by a separate punched card facilitates the handling of program changes and the preparation of new programs.

In a high school of 2,000 students, approximately 14,000 class items must be analyzed and processed from the time the master program is generated until the semester's grades are released. Each of these items will be used a minimum of nine times during the semester. It is apparent that data processing methods can be an important aid in gathering and using educational information. In addition, automatic processing can eliminate many of the time-consuming clerical tasks, level peak loads, and provide more accurate and legible reports for school management.

# DATA PROCESSING AND THE SCHOOL SCHEDULE: A BURROUGHS APPROACH

BY GREG WELTON*

Electronic Data Processing Equipment is merely a tool to aid the user in solving his particular problem. There are several considerations to be evaluated when selecting a specific piece of equipment. Among these are: the rental, programming requirements, maintenance, and the individual manufacturer's experience with your application.

The Burroughs Corporation has had a great deal of experience with Electronic Data Processing in educational circles. One of the areas of experience has been in scheduling.

Scheduling is a two-phase operation. The first phase involves the preparation or construction of an over-all academic schedule of classes, and the second phase involves the scheduling of students to this prepared schedule.

The first phase, the construction of the master schedule of classes, also has two parts. One is estimating enrollments by course, and the other is developing nonconflicting time patterns for these courses. Both parts are difficult in themselves and are subject to human error because of the forecasting nature of this phase of the scheduling function. To develop and bring together the resources of the institution (staff, facilities, and courses), and still to satisfy the curricular requirements of both regular and irregular students, is a monumental task.

The second phase, the scheduling of students to the predetermined schedule of classes, has equal status with the first, for it is the proof of the planning. If the plans (schedule of classes) were inaccurately forecast as to estimated enrollment or necessary time patterns of courses, the curricular requirements of the students will not be satisfied, and the operating costs will be excessive. It should also be pointed out that even

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though the planning of the schedule may have been most accurate, the construction of the student's schedule may not have followed the same rules as were used in the construction of the schedule of classes, with the undesirable result of increased costs and unsatisfied student course requirements.

The planning of the schedule should follow the concept of using the full academic week in order to minimize conflicts in hours of courses. The scheduling of students normally is conditioned on satisfying two objectives: choice of hours and choice of courses. The choice of hours could be rephrased as a concentration of hours (normally M.W.F. mornings) and the planning phase could be retitled the distribution of hours. Concentration and distribution are opposite, and in the scheduling sense are not compatible. They lead to unsatisfied student course requirements and higher costs.

The choice by the student of both courses and hours must be replaced, in part, by a more educationally oriented system of satisfying the course requests of students, not the hour requests of students. Therefore, to reduce the probability of sections of a multiple section course closing early (as they do in a manual system), the program used should instruct the computer to attempt to schedule the student to sections of his course having the most "spaces left," thereby reducing to a very small percentage (less than 1 per cent) the number of students not being able to schedule their first-choice courses because of closed sections of multiple section courses.

Choice of hours, however, is not and should not be arbitrarily eliminated. Many legitimate and academically acceptable reasons for free time do exist.

This, in brief, is the scheduling function. In summary, it is necessary, first, to develop an understanding of the concept of choice of course and distribution of hours, for both are basic to the underlying management principle and success of this data processing system.

Several advantages to a machine operation cannot be directly measured in dollars but clearly improve the over-all efficiency of the institution in the short run as well as the long run.

1. For the first time there is a device for managing the use of the institution's instructional resources, resulting in more effective use of the staff time and improved utilization of facilities. In its simplest form, this concept means that more students can be scheduled to fewer classes by machine than they can by the manual method. Therefore, a smaller instructional staff will be required and less space needed, without class sizes being increased above those specified by the department as being the most effective.

2. Students requiring free time for work, intercollegiate sports and

other activities are scheduled with the free time built into their academic schedule. This advantage produces smoother operations for both students and staff.

3. In the long run, this method can be adapted to processing a larger group of students than the hand method. Without machines to do this work, the time and expenses would increase with resulting higher and higher average costs of registration per student.

It is difficult to justify a computer installation on scheduling alone. In an institution, only serious, thoughtful, and painstaking effort and cooperation on the part of many individuals acting as a team will make an integrated data processing system successful. The computer needs trained and experienced personnel for its proper functioning. The material it memorizes must be prepared with no mistakes; otherwise the computer, no matter how efficient it is, will compound the error at a superhuman speed with only waste paper and lost time as a result.

The Burroughs Corporation has obtained experience in the class scheduling application as well as those other applications peculiar to educational institutions, whether they be at the secondary or college level. A new Electronic Data Processing System, serving the scheduling and other needs of institutions, small or large, has been developed by the Burroughs Corporation, and will be described in an early publication.

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